MECHANICAL HANDLING

INCORPORATING 'MATERIALS HANDLING'

VOLUME 47 NUMBER 7 JULY 1960

REQUIREMENTS OF THE SHIPPING INDUSTRY

THE recommendation by the Chandos Committee that the Government should provide an £18,000,000 loan towards a maximum cost of £30,000,000 required for building a vessel to replace the *Queen Mary*, should give the mechanical handling industry cause to anticipate considerable participation in this project.

The estimated cost has been based on a vessel with a gross tonnage of 75,000 tons, a service speed of 29½ knots, a length of 990 ft and a passenger accommodation for 2,270. It is proposed that the vessel should be designed and powered on lines that are recognized as conventional for ships that are required to cross the Atlantic in less than five days, and are therefore of a type that is generally regarded as unsuitable for any other service.

Although at the time of writing no contract has been placed by the Cunard Steam Ship Company, and no details of the design are therefore available, there can be no doubt at all that if the ship is to meet active competition in the North Atlantic trade, which is considered the most fiercely competitive trade in the world, it will have to be fitted out to meet the highest standards of modern requirements.

Shipbuilders and shipowners are becoming increasingly conscious of the need for making full use of modern methods and equipment offered by the mechanical handling industry in the economic operation and construction of their vessels. This applies not only to the vessels themselves but also in port and harbour facilities and shipyards, a fact that is well borne out by the installations, many of them unique which are at present being built into new ships under construction in British shipyards, and the comprehensive plant that is being installed at docks and harbours throughout the world. Typical examples of this activity have been referred to in recent issues of this journal, in which descriptive articles have been published dealing in particular with new plant installed for the dockside handling of loose materials in bulk, the introduction of an entirely new design of dockside crane, and the interesting and extensive system of baggage conveyors in s.s. *Canberra*, now under construction.

That a good deal more and better use of mechanical handling aids could be made by the shipping industry in general is perhaps only too obvious to those who are closely associated in the manufacture of the plant and equipment. It cannot be denied, however, that a great deal of encouragement can be taken by the considerable progress that has been made recently in utilization of this equipment. British manufacturers can be relied upon to give the utmost co-operation in guidance to the application of their products, whether it be for standard 'off the shelf' items or those designed for a special purpose, and they look forward to a greater opportunity to participate in the construction of the many new vessels that are now being planned, as well as in the re-fitting and modernizing of existing vessels.

Pour les lecteurs de l'étranger
Für unsere ausländischen Leser
Para los lectores de ultramar

SUMMARY OF CONTENTS

For readers overseas

SOMMAIRE EN FRANÇAIS

Tableaux de commande de series, d'opérations dans une usine de sucre Page 456
C'est la description d'un tableau de commande de transporteur très étendu, installé dans un usine de la British Sugar Corporation, Ltd., et qui est analogue à un certain nombre d'autres installations construites par la British Klockner Switchgear, Ltd.

Vers l'automation avec échantillonnage automatique Page 459
Par R. Duley
La prise d'échantillons, ou échantillonnage, a constitué depuis de longues années une pratique courante dans certaines industries, mais ce n'est qu'à l'époque actuelle, avec un emploi toujours plus grand de technologistes et de chimistes, que l'on a adaopté cette habitude dans presque tous les domaines de la production et de la fabrication en série.

Amélioration de l'efficacité des chariots élévateurs à fourche Page 460
Par R. D. T. Foalle
On a récemment procédé aux essais d'un chariot de chantier standard, de chez un constructeur bien connu, de la classe des 1815 kg., en vue d'étudier les grandes variations que l'on sait exister dans le système des pressions hydrauliques, ainsi que leur effet sur les éléments de l'ossature du chariot, et sa charge utile, lorsque le véhicule roule sur des sols inégaux. Grâce à l'introduction d'un accumulateur hydro-pneumatique dans de système, on obtient une meilleure efficacité et une grande sûreté de transport pour les chargements fragiles.

Manutention automatique dans la fabrication en série des ampoules Page 462
Par P. M. Sanders, M.I.Mech.E., M.Inst.T.
Quoique n'étant pas encore terminé, un nouveau système prévu pour le transport automatique des ampoules électriques est en cours d'installation à l'Usine des Lampes Osram, de la General Electric Co., Angleterre. Ce système a été conçu pour transporter 20.000 de ces fragiles ampoules à l'heure, du rez-de-chaussée au 2ème étage, où les ampoules seront montées, puis emballées, soit un transport sur une distance de quelque 65 mètres.

La manutention de la tourbe broyée dans les centrales électriques, 1ère Partie
Par A. G. Kelly, B.E., M.A.S.E., A.M.I. Mech.E. et S. F. Coakley, B.E., B.Sc. Page 466
C'est la première partie d'un article complet décrivant les méthodes de manutention de la tourbe broyée pour la production de l'électricité, appliquées par l'Electricity Supply Board of Ireland (Electricité d'Irlande). Les renseignements donnés dans cet article ne manqueront pas d'être fort intéressants, car les auteurs précisent que l'emploi de la tourbe broyée pour la production d'électricité est inconnu hors de la Russie, d'où l'on n'a pu disposer d'aucun renseignement précis.

Carrière de pierre calcaire mécanisée Page 475
C'est la description d'une carrière, propriété de la Stewarts & Lloyds Minerals, Ltd., et située dans le nord de l'Angleterre, qui est entièrement mécanisée pour le concassage, broyage, triage, criblage, manutention et chargement de la pierre calcaire. Cette installation est conçue pour fonctionner 48 semaines par an et manutentionner environ 8.535 tonnes par semaine.

Manutention à l'aide des chariots industriels, 8ème Partie Page 483
Par L. F. Hoefkens, A.I.Prod.E.
Dans la dernière partie de cette intéressante série d'articles, l'auteur traite de l'emploi des chariots industriels sur la voie publique, de leur utilisation pour balayer et nettoyer et, enfin, pour le chargement des véhicules.

Guide classé des produits des fabricants Page 488
Pour répondre aux nombreuses demandes reçues depuis la fin du 7ème Salon (anglais) de la Manutention Mécanique, organisé par ce journal, nous avons réimprimé le guide classé des produits manufacturés par les exposants. Il est suivi d'une liste des noms par ordre alphabétique, ainsi que des adresses, numéros de téléphone et adresses télégraphiques. Bien que ces listes ne donnent pas tous les fabricants, mais seulement ceux qui ont exposé au Salon, elles constitueront certainement un moyen de référence utile à un grand nombre de fabricants anglais de matériel et d'équipement de manutention mécanique.

Nouvelles de personnalités Page 500
Revenue du matériel nouveau Page 504
Notes et avis professionnels Page 508
Sommaires et Références Page 511
Brevets récents Page 513

INHALTSÜBERSICHT AUF DEUTSCH

Zeitfolgeschalttafeln in einer Zuckerfabrik Seite 45
In diesem Artikel wird eine Grossschalttafel fur Förderanlagen beschrieben, die kürzlich in einer Fabrik der British Sugar Corporation ähnelt in der Konstruktion einer Reihe anderer von der Fa. British Klockner Switchgear Limited hergestellte Anlagen.

Automatisierung mit automatischer Probeentnahme Seite 45
von R. Duley
Das Entnehmen von Proben ist

manchen Industrien schon seit Jahren üblich, aber erst heute, bei der ständig zunehmenden Beschäftigung von Technologen und Chemikern in der Industrie hat dieser Vorgang fast in allen Sparten der Fabrikation und Fertigung Eingang gefunden.

Steigerung der Gabelstaplerleistung Seite 460
von R. D. T. Foalle
Versuche wurden kürzlich an einem Lagerplatz-Gabelstapler der 1815-kg-Klasse einer bekannten Herstellerfirma mit dem Ziele durchgeführt, die bekanntlicherweise bei hydraulischen Systemen vorkommenden Druckschwankungen und deren Auswirkung auf die Bauteile der Stapler und ihre Nutzlast zu untersuchen, wenn das Fahrzeug unebene Oberflächen befährt. Durch Einschaltung eines hydropneumatischen Akkumulators wird unter Wahrung der Sicherheit bei der Förderung zerbrechlicher Waren eine grössere Nutzleistung erzielt.

Automatische Förderanlage für Lampenbirnen Seite 462
von P. M. Sanders, M.I.Mech.E., M.Inst.T.
Eine neue, allerdings noch nicht ganz fertige Anlage für die automatische Förderung von Lampenbirnen wird z.Zt. in der Osram-Lampenbirnenfabrik der General Electric Co., Ltd., England eingebaut. Die Anlage soll 20 000 Birnen pro Stunde über eine Entfernung von 60 m vom Erdgeschoss zum 2. Stock fördern wo die Lampen montiert und verpackt werden.

Förderung von gemahlenem Torf in Kraftwerken, Teil I Seite 466
von A. G. Kelly, B.E., M.A.S.M.E., A.M.I.Mech.E., und S. F. Coakley, B.E., B.Sc.
Dies ist der 1. Teil eines ausführlichen Artikels, in dem die Methoden zur Förderung von gemahlenem Torf für die Energieerzeugung durch die irische Elektrizitätsbehörde beschrieben werden. Dieser Artikel dürfte insofern von Interesse sein, als die Verfasser angeben, die Anwendung von gemahlenem Torf für die Energiewirtschaft sei ausserhalb Russlands unbekannt, von wo keine ausführlichen Informationen vorliegen.

Mechanisierter Kalksteinbruch Seite 475
In diesem Artikel wird ein der Fa. Stewarts & Lloyds Minerals, Ltd. gehöriger Steinbruch im Norden Englands beschrieben der für das Zerkleinern, Klassieren, Sieben, Fördern und Verladen von Kalkstein vollmechanisiert ist. Die Anlage ist 48 Wochen pro Jahr bei einer Leistung von etwa 8535 Wochentonnen im Betrieb.

Materialförderung mit Industriefahrzeugen, Teil 8 Seite 483
von L. F. Hoefkens, A.I.Prod.E.
Im letzten Teil dieser interessanten Artikelreihe befasst sich der Verfasser mit der Anwendung von Industrielfahrzeugen auf öffentlichen Strassen, ihrer Anwendung zur Strassenreinigung und auch als Ladegeräte.

Aussteller-Warenverzeichnis Seite 488
Um den vielen seit Assschluss der von dieser Zeitschrift veranstalteten 7. Fördertechnischen Ausstellung eingegangenen Erkundigungen und Anfragen gerecht zu werden, haben wir einen Nachdruck der von den Ausstellern hergestellten Erzeugnisse herausgebracht. Ein alphabetisch geordnetes Verzeichnis der Firmennamen mit Adressen, Telefonnummern und Telegrammadressen folgt. Obwohl diese Listen nicht sämtliche Aussteller erfassen, sondern nur die auf der Ausstellung vertretenen, dürften sie dennoch eine nützliche Informationsquelle über eine grosse Zahl britischer Fabrikanten fördertechnischer Geräte und Ausrüstungen darstellen.

Persönlichkeiten in der Industrie Seite 500
Neue Geräte Seite 504
Branchennachrichten Seite 508
Auszüge und Schrifttum Seite 511
Neue Patente Seite 513

SUMARIO EN ESPAÑOL

Paneles de control de orden de operaciones en una fábrica de azúcar Pág. 456
Es ésta una descripción de un extenso tablero de control de transportadores instalado en una fábrica de la British Sugar Corporation Ltd., el cual es análogo a un cierto número de otras instalaciones producidas por los fabricantes British Klockner Switchgear Ltd.

Hacia la automatización con extracción automática de muestras Pág. 469
Por R. Duley
La toma o extracción de muestras durante mucho años ha sido prática corriente en algunas industrias, pero es sólo en la época actual, con su incremento en el empleo de técnicos y quimkcos, ha llegado esta práctica a extenderse a casi todas las esferas de la producción y fabricación.

Mejora de la eficiencia de los carretones de horquilla elevadora Pág. 460
Por R. D. T. Foalle
Han sido llevidas a cabo recientemente pruebas con un carretón standard de un conocido fabricante, de la clase de 1815 kg, con objeto de investigar las grandes variaciones que se sabe existen en las presiones de los sistemas hidráulicos, así como sus efectos sobre los elementos estructurales del carretón y carga caundo el vehículo se traslada sobre superficies desiguales. Introduciendo en el sistema un acumulador hidroneumático se consigue una mayor eficiencia, así como el transporte sin reisgo de cargas frágiles.

Manipulación automática en la producción de lámparas eléctricas
Por P. M. Sanders, M.I.Mech.E., M.Inst.T. Pág. 462
Aunque no está terminado, se está instalando un nuevo sistema para el movimiento automático de bombillas eléctricas en la Fábrica de Lámparas Osram de la General Electric Co., Ltd., de Inglaterra. Este sistema ha sido diseñado para llevar 20,000 de las frágiles bombillas por hora desde la planta baja hasta el segundopiso, donde se efectúa el montaje y embalaje de las mismas, siendo la distancia de 60 metros.

Manipulación de turba cortada en las centrales eléctricas, Parte I Pág. 466
Por A. G. Kelly, B.E., M.A.S.M.E. A.M.I.Mech.E., y S. F. Coakley, B.E., B.Sc.
Es ésta la primera parte de un artículo completo en el que se describen los métodos de manipuleo de turba cortada para la producción de energía usados por la Junta de Suministro de Electricidad de Irlanda. La información contenida en estos artículos tiene que resultar de interés por cuanto afirman los autores que la turba cortada para la producción de energía es desconocida fuera de Rusia, de donde no se han obtenido datos detallados.

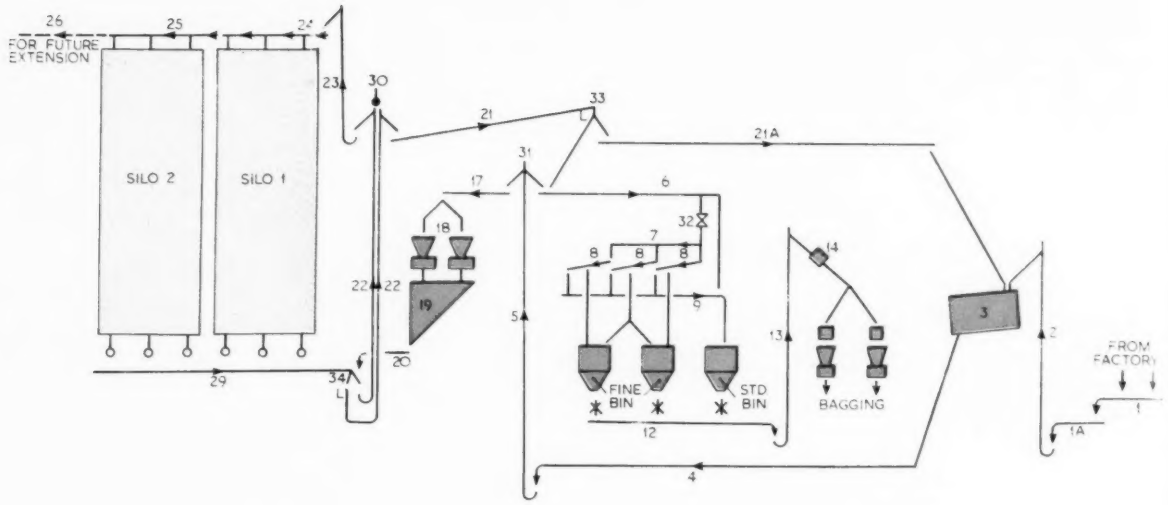
Cantera de piedra caliza meconizada Pág. 475
Viene aquí una descripción de una cantera propiedad de Stewarts & Lloyds Minerals, Ltd., situada en el norte de Inglaterra, la cual está totalmente mecanizada para la trituración, clasificación, cribado, manipulación y carga de la piedra. Está construída para funcionamente durante 48 semanas cada año y para trabajar approximadamente 8535 toneladas métricas por semana.

Manipulación con carretones industriales, Parte 8 Pág. 483
Por L. F. Hoefkens, A.I.Prod.E.
En la parte última de esta interesante serie de artículos el autor trata del uso de los carretones industriales en la via pública, su uso para barrer y limpiar, y finalmente para la carga de vehículos.

Guía clasificada de los productos de los fabricantes Pág. 488
Para cumplimentar las consultas y solicitudes que han sido recibidas desde que cerró sus puertas la *7a* Exposición del Manipuleo Mecánico, organizada por esta Revista, hemos reimpreso una guía clasificada de productors fabricados por los expositores. Sigue después una lista de nombres en orden alfabético, junto con sus direcciones, números de teléfono y direcciones telegráficas. Aunque estas listas no abarcan todos los fabricantes, sino sólo los que participaron en la Exposición, tienen que constituir un elemento de consulta de utilidad, por cuanto figuran en ellas un crecido número de fabricantes británicos de instalaciones y equipos de manipulación mecánica.

Noticias sobre personalidades Pág. 500
Revista de los equipos que constituyen novedad Pás. 504
Notas del ramo Pág. 508
Extractos y referencias Pág. 511
Patentes de focha reciente Pág. 513

SEQUENCE CONTROL AT SUGAR FACTORY



KEY
Starting Sequence

No. 1 9, 8, 7, 32 open, 6, 31 to bins, 5. 4, 3, 2, 1A, 1
No. 2 14, 13, 12
No. 3 25 followed by or start at 24, 23, 30 to silo, 22, 20, 18, 17, 31 to silo, 5, 4, 3, 2, 1A, 1
No. 4 30 to silo, 34 latched, 29, any combination of subsidiary belts and sequence 3
No. 5 25 followed by or start at 24, 23, 30 to silo, 22, 34 oscillating, 29, sub. belts
No. 6 9, 32 shut, 6, 33 latched, 21, 30 central, 22, 34, 29, sub. belts, 25 followed by or start at 24, 23, 30 central, 22, 20 18, 17, 31 to silo, 5, 4, 3, 2, 1A, 1 and sequence 2
No. 7 Sequence 2, 9, 32 shut, 6, 33 latched, 21, 30 to bins, 22, 34 oscillating, 29, sub. belts and optional sequence 7A, 31 to bins, 5, 4, 3, 21A, 33 oscillating

Fig. 1. Diagram of plant layout and sequences

THE conveyor control panel installed at the Brigg factory of the British Sugar Corporation Limited is typical of several such panels manufactured and supplied by British Klockner Switchgear Limited to the Corporation over the last few years. In this form of construction all starters are mounted in one interlocked compartment, making for compactness and eliminating the problem of isolating a multiplicity of control connections which would be required by cubicle constructions on such a multiple sequence arrangement.

The conveyor system controlled by the panel takes the sugar in its final state from the factory, and after cooling and weighing, either puts it into one or other of the silos, or after separation of fine and standard sugar and passing through a magnetic separator, supplies it to the bagging machines.

Fig. 1. shows in diagrammatic form the layout of the plant together with the sequences required. These are given as starting sequences, as are those in the opposite direction of the sugar flow, so that failure of any unit stops all units feeding sugar to that point, and prevents material build up. The diagram is self-explanatory, except for the flaps, 30, 31, 33 and 34. All these are motor driven and controlled from selector switches on the push-button panel, and are included in the interlocking so that a particular starting sequence may not progress beyond the flap until the flap is in the correct position and the correct limit switch operated.

Flap 30 is a three-position device, arranged to deflect the entire output, 40 tons/hr, of the ganged elevator 22, either to elevator 23 or conveyor 21. The central position allows the two sections of elevator 22 to deliver their outputs separately to 23 and 21. Flap 31 is merely a two-position device to deflect the entire output of elevator 5 to conveyors 6 or 17.

Flaps 33 and 34 may either be latched in the position indicated by 'L' on the diagram, or by running the driving motor continuously, made to oscillate and divide the flow equally between the two outlets. Thus, the 40 tons/hr from conveyor 29 may be divided between the two sections of elevator 22, each rated at 20 tons/hr. Special limit switches are fitted to these, oscillating flaps, since they are required to operate 17 times/min for very long periods. Under these conditions the flap position indicators are continuously illuminated at some low level, and made to brighten momentarily as the limit switch is depressed.

Items 32 and the flap controlling the output of conveyor 17 are both manually controlled. The latter unit is fitted with limit switches working in conjunction with tidal-level devices on items 18 and connected into the interlock circuit so that if the hopper of 18, which is in use, becomes full,

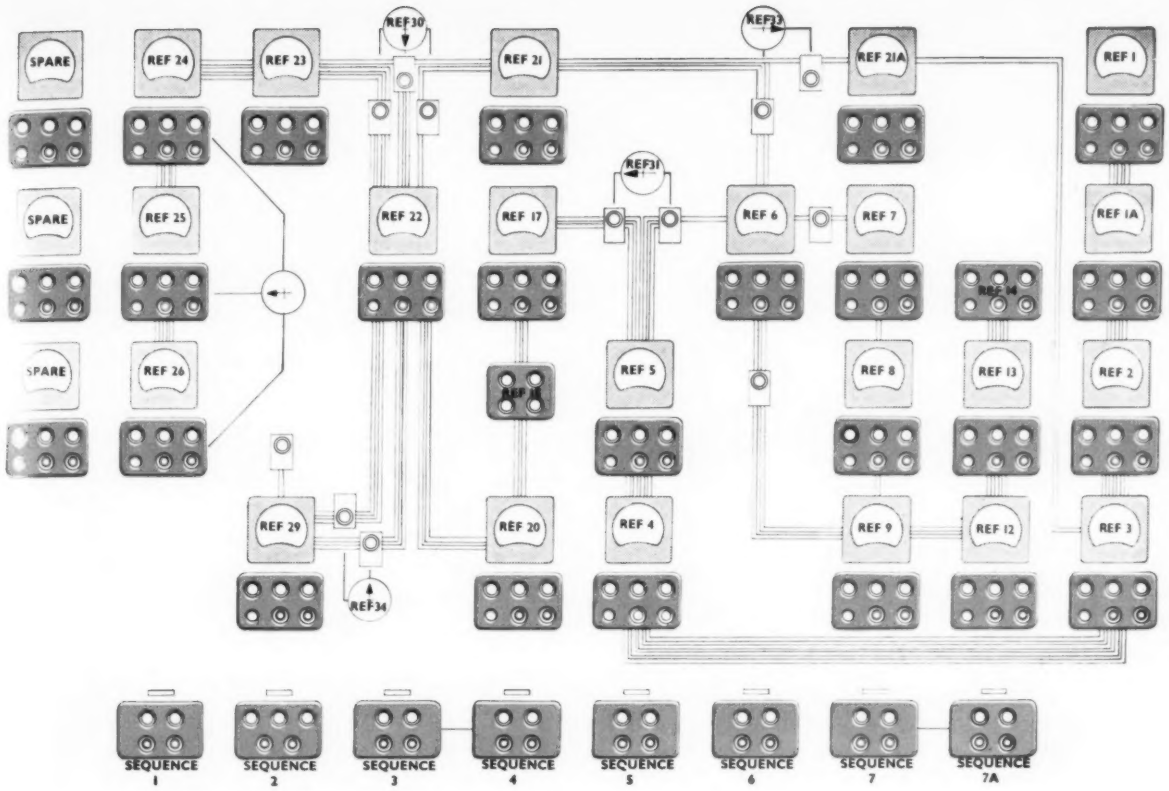


Fig. 2. Layout of control panel

Fig. 3. Two small starter panels installed under the silos for controlling the subsidiary belts

then the sequence is interrupted, but the operator is free to adjust the flap to keep both hoppers at some intermediate level without interrupting the sequence.

The sequences are selected by means of push buttons, and these are so interlocked that once any sequence is selected, all conflicting sequences are locked out. Miniature indicators show when a particular sequence has been selected. After the sequence has been fully set up then a further 'sequence running' indicator is illuminated, and the 'sequence selected' indicator is extinguished.

The individual push buttons, ammeters and motor indicators are mounted on the push-button panel in a layout as shown in Fig. 2, and the similarity between this and Fig. 1 is obvious. Coloured flow lines indicate the starting sequence, and these are reinforced by white 'Ready' indicators on the next unit to be started in a particular sequence. All other 'Start' buttons are inoperative so that it is impossible to make a mistake in starting. Certain units are fitted with underspeed switches, and in starting these units the 'Start' button must be held until the driven shaft is up to speed. The ammeter indicates this quite adequately, and the operator merely holds the button until the ammeter drops back towards the marked 'full load current'.

Separate 'Run/Test' switches are provided for each unit, and with the switch in the 'Test' position, the unit may either be inched on its panel 'Stop' button or from a remote position adjacent to the motor. These remote stations are also equipped with lock-off 'Stop' buttons for emergency use, and when these are depressed, the sequence up to that point is interrupted and an indicator illuminated on the push-button panel.

Individual motor fuses are mounted in compartments below the push buttons, and arranged so that the fuses for a particular unit are as nearly as possible directly below that unit's push buttons.

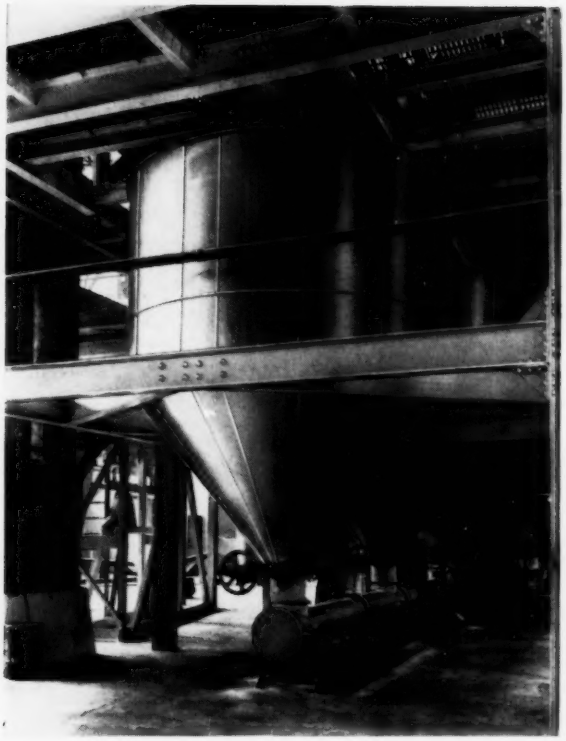
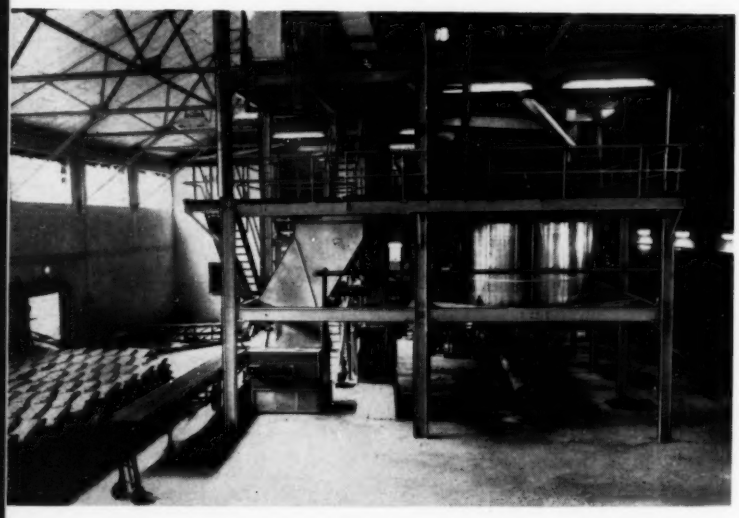


Fig. 4. Bins for receiving fine and standard sugar after screening, with enclosed conveyor below

The starters for the 44 subsidiary belts and screw conveyors collecting sugar from the silo and feeding on to item 29, are themselves mounted below the silo in two small cabinets, These may normally only be run when 29 is running, but it is possible to inch them for test purposes when 29 is stationary. Some interlocking between these subsidiary belts is incorporated when it is necessary for one to feed into another before feeding item 29.

Fig. 6. General view of the bagging room, note portable conveyor



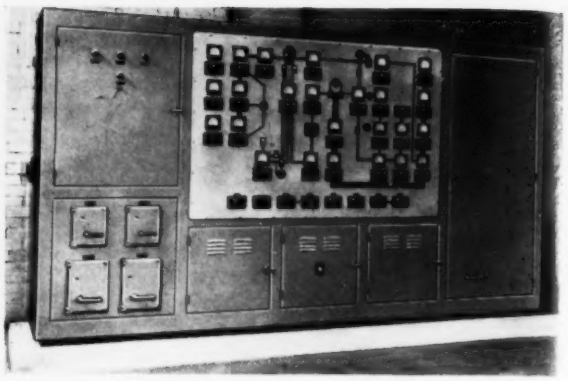


Fig. 5. The panel with certain sequences running

Fig. 7. The cubicle-type board installed at the Bardney factory

A total of some 200 h.p. is thus controlled from the panel, mainly in small units, and all are protected by thermal overload devices, and all, except item 29, switched by contactor type D1.25. A special feature of the indicator circuit is that switching is kept to the barest minimum. For example, the contactor-coil secondary-fed 'running' indicators are connected to the 'Ready' indicators in such a manner that the volts from the contactor secondary 'back-off' the volts on to the 'Ready' indicator and so extinguish same. This eliminates faulty or poor indication caused by dirty contact at low voltage.

When flaps 33 and 34 are oscillating, a special detector device comes into operation and is arranged to shut down the sequences if the flap limit switches do not operate more frequently than a certain minimum. Since the conveyor system is handling finished sugar, all foreign matter must be kept out of the system by total enclosure and dust extraction. Air conditioning is installed in the silos themselves to minimize moisture absorption and the entry of airborne spores which would cause fermentation. The power supply for these items is obtained from the control panel by means of fused isolators.

The panel installed at Bardney is of the cubicle type, and since it is a single sequence type, no more than three auxiliary poles are required on the individual isolators. Again, unlike the Brigg panel, most of the motors controlled by this panel are of a fair size so that although only 19 motors are controlled, the total h.p. is almost 400.

TOWARDS AUTOMATION WITH AUTOMATIC SAMPLING

by R. D. Duley*

THE taking of samples, or sampling, has for many years been common-practice in some industries, but it is only the present era with its increased use of technologists and chemists that has taken the practice into nearly all fields of production and manufacture.

While it is obvious that these days sampling and quality tests are carried out on products such as motor cars and their components, as well as many other mass-produced goods of this nature, it is intended to confine this article to the more complex sampling required from bulk materials, either solid or liquid.

The present-day standards of quality, hygiene and consistency call for a rigorous system of sampling, if proper technical control of processing operations is to be achieved. This applies equally whether the product is a basic material, or an intermediate or end product.

Whether the feed or process is continuous or in batches, sampling must be carried out accurately and at regular intervals, if the information obtained after analysis is to be relied on. Therefore, sampling should not, as is often the case, be left for 'old George' to dip in a bucket or take the odd shovel full, as it is apparent that the sample extracted by 'old George' will not be truly representative of the mass, and subsequent analysis a waste of time and labour. By using a well-designed automatic sampling machine an accurate sample can be taken and so enable the laboratory to keep its check on the full flow of material being handled.

The most important requirement of the automatic sampling machine is that it takes a true cross section of the material being conveyed, and that this cross section is taken at predetermined regular intervals during production. By doing this the close control required can be maintained without the possible error and cost involved in manual sampling.

These automatically taken samples can be taken from most bulk solid or liquid materials provided they are flowing continuously for a given period.

A sample from solids is best taken while the material passes from one stage in the process to another, as at the discharge of a belt conveyor, chute or hopper, etc. With a liquid this can be where it falls from one launder into another, or where it discharges from a pipe. Two typical examples are shown in the diagrams.

*Mec-Handling, Ltd.

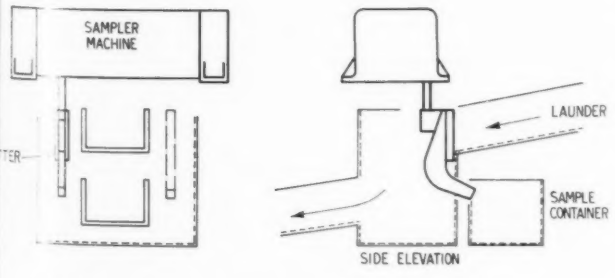


Fig. 2. Typical arrangement for sampling wet material

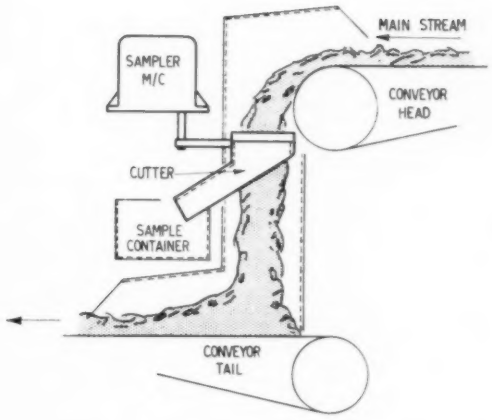


Fig. 1. Drawing showing a typical arrangement for sampling dry material

Although the use of automatic samplers is new to many industries, they have been a recognized necessity in mining plants for the past 35 years, and it is a fact that every mine throughout the world uses automatic samplers of this nature to extract the samples of ores, coal, ore pulps, etc., from the bulk material. Apart from mining, they also have a great potential in sampling a wide range of materials such as sand, cement, chemicals, sugar, flour,meal, sewerage, and other waste liquids.

To obtain an accurate sample it is essential the automatic sampler must have the following recognized principles incorporated in its design:

(1) The sample taking chute or cutter must travel in a straight line and at right angles to the stream of material being sampled, as well as passing clear of the stream at the end of each sample taking cut.

(2) The speed of the cutter must be constant throughout its entire travel, although this speed is determined by the material being handled and the amount of sample required.

These first two requirements will ensure equal percentages to be taken from all parts of the stream, and that a true cross section is taken, over the period it takes the cutter to move across the stream.

(3) The traversing sample taking chute or cutter must have a distance between its cutting edges great enough to allow free passage of the largest material. This is usually three times the size of the largest piece, although no rule can be made, as a lot depends on the material being handled.

(4) The interval between taking sample cuts should be constant and frequent enough to ensure that not only is a representative sample taken but any abrupt change in the

quality or consistency of the material is brought to the notice of the controlling technicians.

To eliminate any stoppages in the sampling process, it should be added that the machine must be of simple design and yet mechanically dependable for continuous operation over long periods with a minimum of attention and maintenance.

It can be seen from the diagrams, the sample cutter is designed to take the sample, and direct it into a small sample hopper adjacent to the sampling point. This cutter plays an important part in the sampling and its design and material is dependent on position of the sampler machine in the plant and also material being handled.

For ore pulps and wet materials generally a cast-iron cutter is used; for dry materials a fabricated steel cutter is employed, but where acid pulps, edible foods, agricultural produce, or sticky materials are involved, stainless steel, aluminium, rubber covered or even glass cutters are necessary.

The length of travel for the cutter is determined by the width of belt or pipe diameter at the point at which the sample is taken, and, as previously mentioned, must take the cutter clear of the flow at each end of its travel.

The *Geco* Sampler which has been developed through the years is now manufactured by Mec-handling, Ltd. This machine is claimed to meet all the basic requirements of correct sampling and has been approved by such concerns as the National Coal Board, Imperial Chemical Industries and Tate & Lyle, etc., as well as having been used for many years in mining plants throughout the world.

IMPROVING FORK LIFT TRUCK EFFICIENCY

By R. D. T. FOALLE *

TRIALS have been carried out recently on a well-known manufacturer's standard yard truck of the 4,000-lb class with the object of investigating the very large variations known to exist in the hydraulic system pressures and their effect on the structural members of the truck, and also on the payload, when the vehicle is travelling over anything rougher than smooth shop floors.

It is common knowledge among all fork truck users that extreme caution must be exercised when driving over even moderately rough ground to prevent shifting of the payload and to reduce jolting of both truck and driver. Driving with caution usually means driving at a slower speed with a consequent reduction in the efficiency of the truck. For fragile loads it is not always sufficient to drive with caution and, in order to overcome any risk of damage, special cradles and ancillary attachments have to be provided. The trials, mentioned above, proved that by the installation of a hydro-pneumatic accumulator into the hydraulic system perfect safety was achieved when carrying maximum load at top speed, without having to resort to any special precautionary methods.

The figures obtained during the test are of considerable interest. In connection with hydraulic pressure it was found that with a full load up and a normal system pressure of 800 lb/sq. in. when travelling over $\frac{1}{2}$-in ground projections, the pressure varied from 200 to 1,500 lb/sq. in., creating shock loads on the forks of more than double the maximum rated capacity of the truck.

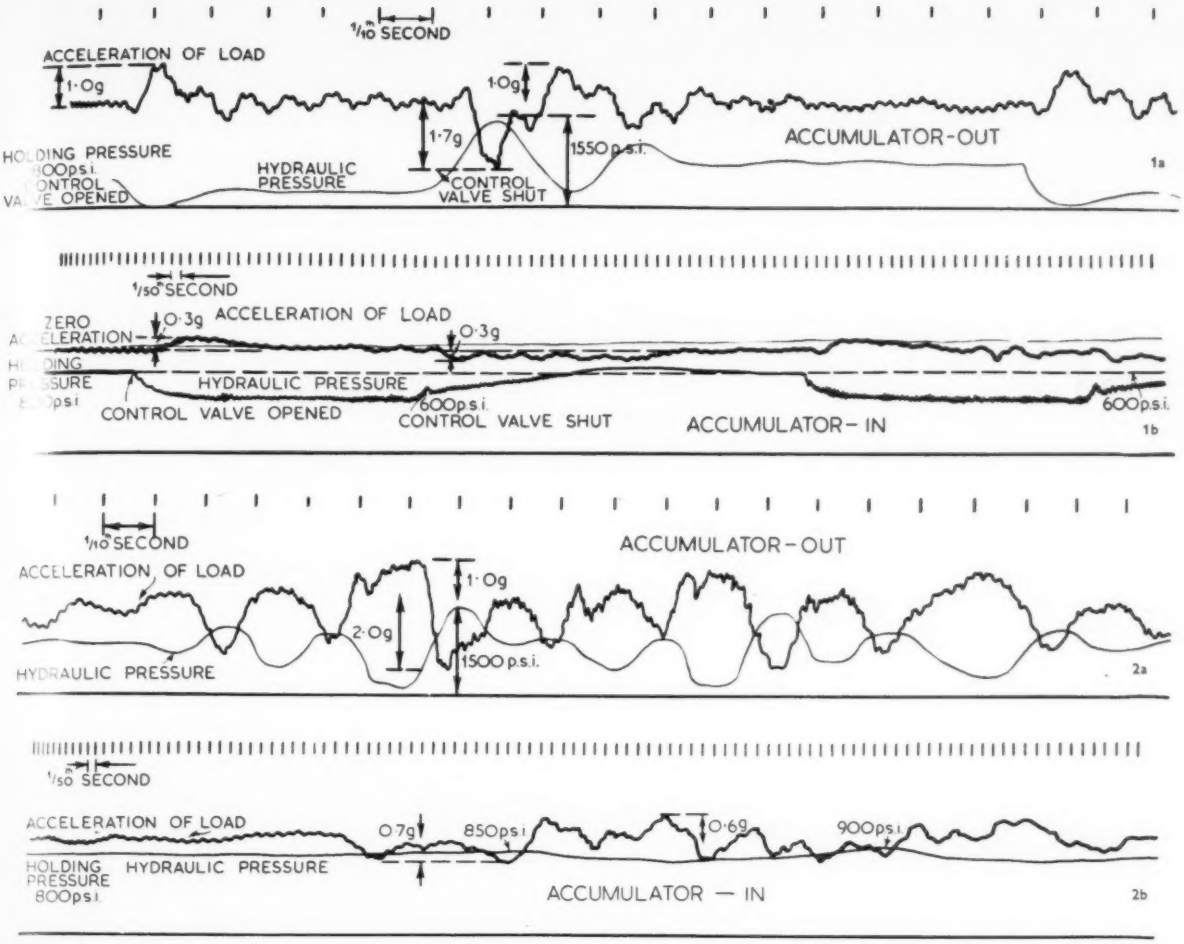
It was also established that even with the truck stationary and the load lowered at normal speed (flow control was an integral part of the system), sudden arrest of the load by release of the control valve handle produced pressure surges of almost twice the maximum rated value. Similar proportional figures were recorded with varying loads. The oscilloscope traces reproduced, Figs. 1a, 1b, 2a and 2b, are actual records taken during these trials.

The introduction into the hydraulic system of a hydro-pneumatic accumulator, Fig. 3, is a simple matter. Its effect is to convert the comparatively hard springing of a rigid hydraulic system to the 'air-cushion' suspension normally associated with high-priced cars, thus providing greater efficiency to both driver and truck coupled with safe transport for fragile payloads.

Fork truck fitted with a Greer-Mercier hydro-pneumatic accumulator

The method of testing involved apparatus consisting of a variable bridge—strain-type pressure transducer fitted into the hydraulic line between the control valve and the main lifting cylinder, and a capacitance-type 'accelerometer'

* Development Engineer hydraulic section Fawcett Preston & Co., Ltd.



Figs. 1a, 1b, 2a *and* 2b. *Reproductions of actual oscilloscope traces taken during trials.* 1a *Truck stationary—load being lowered and stopped, maximum load without accumulator.* 1b. *Truck stationary—load being lowered and stopped, maximum load with accumulator in circuit.* 2a. *Truck traversing 'rough ground', maximum load without accumulator.* 2b. *Truck traversing 'rough ground', maximum load, accumulator in circuit*

Fig. 3. *Section through the hydro-pneumatic accumulator*

attached to the forks and a three-channel oscilloscope.

The transducer transmitted electronic impulses proportional to the hydraulic pressure variations to one of the cathode ray tubes of the oscilloscope; the accelerometer relayed electronic impulses proportional to the accelerating forces in the vertical plane on the forks and was connected to a further cathode ray tube. Both traces on the cathode ray tubes were recorded by the use of a mirror reflecting system on to a single strip of sensitive photographic paper passed at a predetermined speed before the tubes.

Reproductions of the traces thus obtained are shown in Figs. 1a, 1b, 2a and 2b, recorded with the maximum 2-ton load in position. The results both with and without an accumulator in circuit are clearly shown. The traces 1a and 1b were recorded while the truck was stationary, the load being lowered and suddenly stopped by release of the control valve; the smoothing out of the pressure and acceleration peaks due to the introduction of an accumulator is clearly illustrated. The results obtained when running the loaded truck at full speed over a series of $\frac{1}{2}$-in thick plates are shown in Figs. 2a and 2b. In this latter test it was observed physically that the load rode gently and safely on the hydro-pneumatic cushion, a fact that is well substantiated by the traces.

The illustration on page 460 shows a fork truck, fitted with a Greer-Mercier hydro-pneumatic accumulator, in action at the Bromborough works of Fawcett Preston & Co., Ltd. (a Metal Industries Group company), who manufacture the accumulator and who are now planning production of a special model to serve the particular needs of the mechanical handling field.

Automatic Handling in Electric Lamp Production

New Selective Bulb Conveyor System installed at the Osram Lamp Works of the General Electric Co., Ltd.

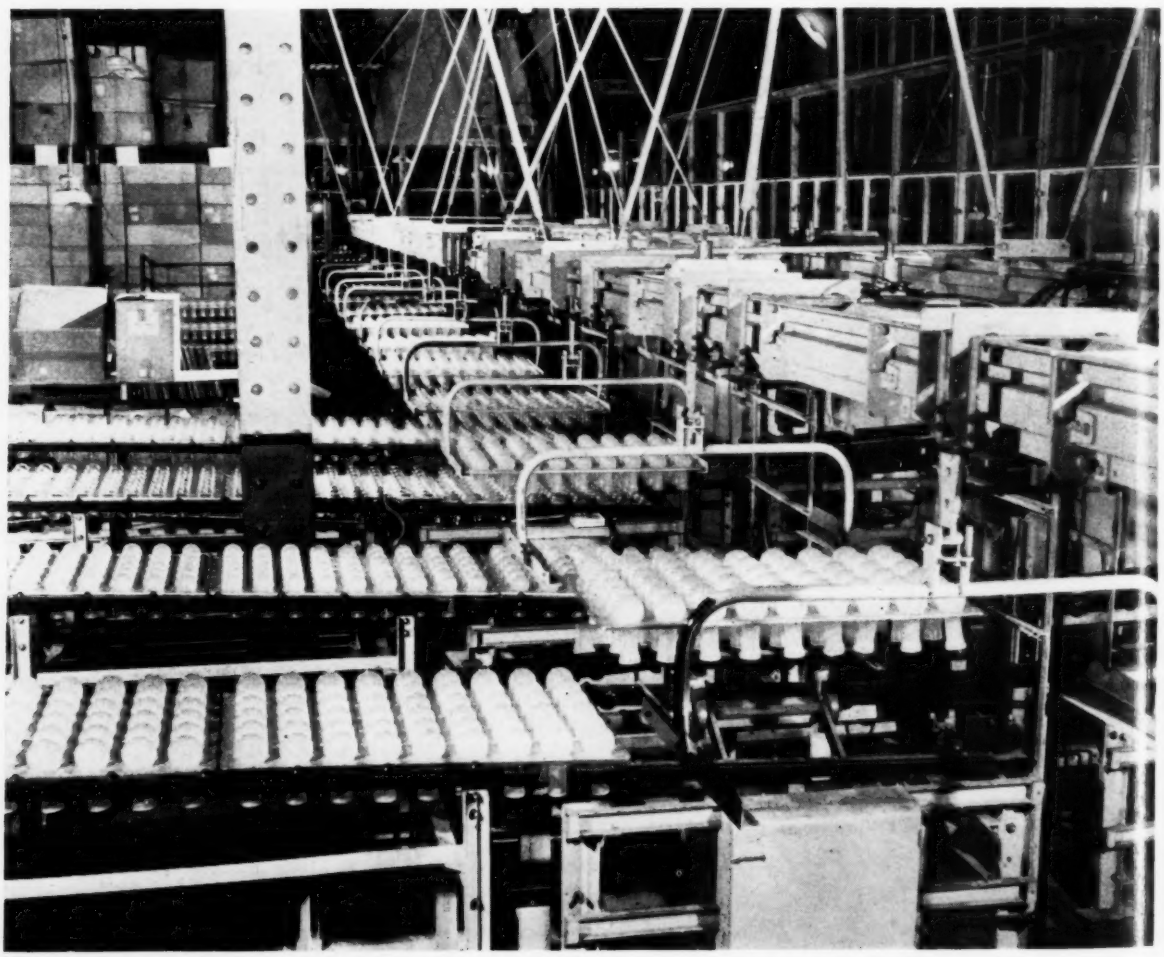
By P. M. Sanders, M.I.Mech.E., M.Inst.T.

THOUGH not yet completed, the new system for the automatic conveyance of electric lamp bulbs being installed in the Osram lamp works at North Wembley of the General Electric Co., Ltd., has well demonstrated its value not only for saving much time, labour and floor space, but also for reducing handling by the workers and the number of breakages. It cuts out, in fact, four separate manual operations. It is designed to carry 20,000 of the fragile bulbs per hour from the ground floor to the second floor where the lamps are assembled and packed, a distance of 250 ft.

The bulbs, which are delivered in cartons on the ground floor, have hitherto been unloaded, fitted into trays and, after being washed and dried have been taken by a lift up to the second floor and hand-loaded on to special trolleys for conveyance to the lamp production machines and the crown imprinting of the lamp rating, etc. The production areas of considerable length, necessitating many long trolley journeys to the machines and back to the lift for reloading. Conveyance by trolley as well as handling for imprinting will be entirely eliminated when the new installation is in full operation. Moreover, after being unloaded from the cartons and placed on the conveyor system, the bulbs are not touched by hand again until they have been made into lamps.

The basis of the new system is the installation by Teleflex

Fig. 1. Showing four of the loading ramps in the tray-loading bay and the conveyor line passing over the pneumatic lifts by which the loaded trays are transferred on to the hangers for conveyance to the production floor



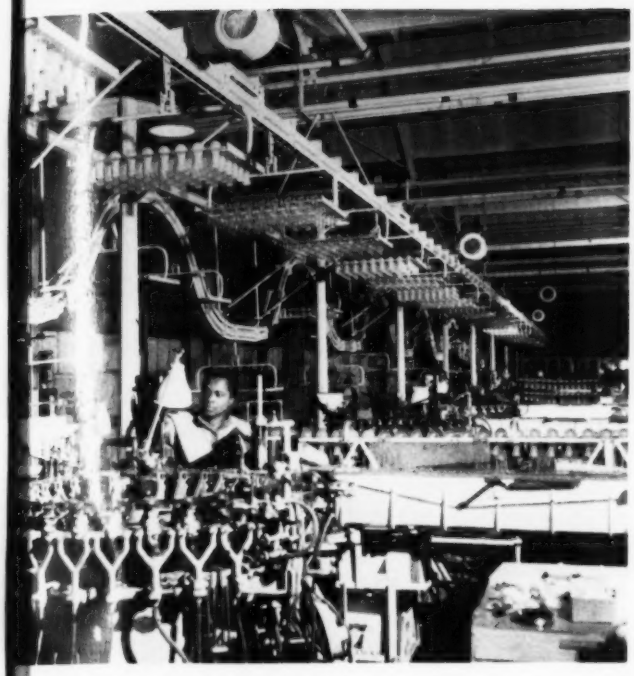


Fig. 2. The conveyor line passing over the lamp production machines and bringing bulbs from the tray-loading bay to be unloaded on to the transfer units from the dipped portions of the conveyor

Products, Ltd., of their Teleflex endless chain conveyor. This is equipped with 110 hangers at 5 ft 4-in centres that carry steel-framed aluminium trays, each perforated with six rows of nine holes to support 54 bulbs in the inverted upright position. Chain-driven by a 1¼-h.p. brake motor on the second floor, the conveyor passes round an idle sprocket at one end of the loading bay on the ground floor so that there are two parallel lines moving in opposite directions at about 5 ft 6 in above floor level over the ends of ten loading ramps placed in parallel. It is understood that provision has been made for the addition of two more ramps at a future date. The two conveyor lines pass through the first and second floors and run in opposite directions at a height of about 10 ft above ten parallel groups of production machines. At a travelling speed of about 40 ft per minute, the conveyor will feed 2,000 bulbs per hour to each of ten groups. At present it is run at a lower speed suitable for about 1,500 to 1,800 per hour. In any case it is important that it should feed slightly faster than the production rate of the machines to ensure an uninterrupted supply.

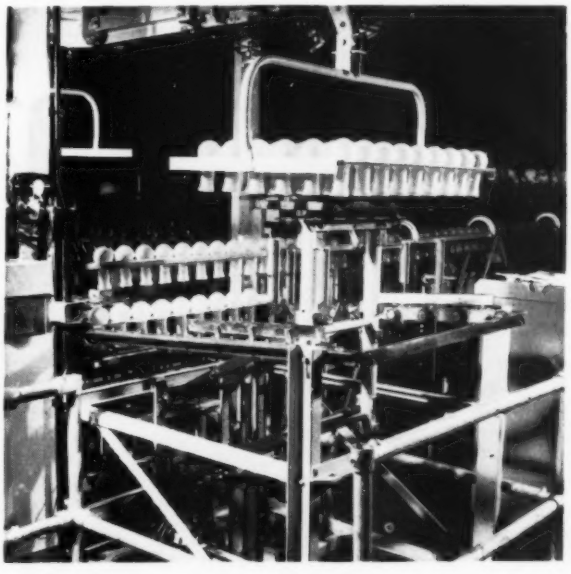
At one end of each loading unit on the ground floor is a table on to which the bulbs are tipped by hand from the cartons. Sloping down from the table is a ramp on which an attendant places the carrier trays and loads each with 54 bulbs by hand from the table. Each full tray then runs down the ramp on ball-bearing rollers under the edges and between rollers at the sides to a position above a pneumatically operated lift by which it is raised to a height at which it is picked up by a passing hanger on the nearer conveyor line to be taken up to the production floor. Any broken bulbs are thrown into a well below the tray loading table. Each of the ten loading ramps is associated with a machine group on the production floor, every tenth hanger feeding one particular group.

Selective delivery to the production groups and return of the empty trays to the associated loading ramps permits each of the ten groups to be employed for producing a different type of lamp, in pearl, clear or silverlight finish. It is achieved by an automatic control system whereby pilot valves admitting air pressure to the lifts are triggered by the passing hangers. The valves are mounted on the conveyor housing above the lifts on the approach side and are operated by cams on the hangers. Each cam is carried by two parallel steel rods projecting horizontally from one side of the hanger member to which the tray-carrying portion is pivoted. Its lateral position is adjustable so that it can be placed where it will operate only the pilot valves controlling the loading and unloading lifts of one loading unit on the ground floor and those of its associated production group on the second floor which, as described below, perform a similar function.

The loading unit lifts may be rendered inoperative by solenoid-actuated valves under control of the attendants. At present these put them out of action at the end of working hours, but as the conveyor system is not stopped until some four or five minutes later, a certain number of trays are carried past the unloading lifts. Thus, when the loading units are put into operation next morning, the loading lifts may attempt to place full trays on to hangers already carrying empty ones, with resulting collisions and possible damage to the bulbs and conveyor. This danger is averted by the use of delay switches with dials that are set to cause the lifts' action to be initially delayed, usually for about two minutes, during which time any unloaded hangers are carried past the temporarily inoperative lifts, to be unloaded as they again circuit the system.

A projected improvement is to install photo-electric cell equipment which will warn the attendants of the approach of loaded hangers so that they can stop loading-lift action until they have passed. Throughout the day a certain number of trays are not unloaded on the production floor, as the conveyor feeds bulbs to the machines slightly faster than they require, and they are carried with their bulbs down to loading units to be again handled by the attendants. These will also be detected by the photo-electric equipment which will automatically stop operation of the appropriate unloading lifts until they have passed them, and the attendants will be warned to immobilize the lifts while they would otherwise attempt to double the hanger loads.

Fig. 3. A tray of bulbs arriving at the transfer table of one of the production machine groups. Below the table is seen the pneumatic lift that lowers the tray off the hanger and on the latter the cam which opens the pilot valve that admits air pressure to operate the lift



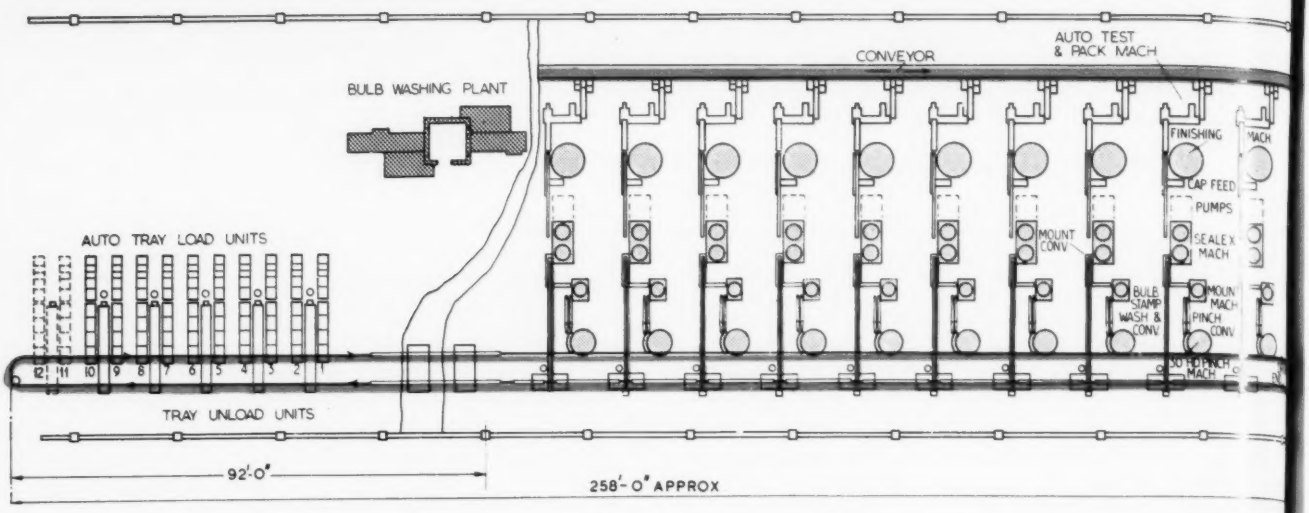


Fig. 4. Layout of the Teleflex conveyor system at the Osram lamp works, showing, on the left, the tray-loading ramps on the ground floor and, on the right, the bulb transfer units and production machine groups on the second floor

On the production floor the conveyor line carrying loaded trays is dipped down above the transfer units at the input ends of the ten production machine groups. Each transfer unit consists of a table under which are two pneumatic lifts by which loaded trays are lifted off the hangers and, when unloaded, are replaced on them for conveyance to the loading bay below. As previously noted, operation of the lifts is controlled by pilot valves triggered by the same cams that actuate those of the associated loading unit. By means of pneumatic plungers, described below, the bulbs are transferred from the table on to a special conveyor running at right-angles to feed them to the production machines. The air supplies for these operations are controlled by three interlocked hand levers, the top one for the pilot valves, the second for the lifts and the third for the plunger equipment. In the down position the top lever holds down the other two, shutting off air supplies to the whole transfer unit so that it cannot accept trays from the main conveyor, should it be running, or return any to it, thus averting any danger of collisions and consequent damage.

Installed by the General Electric Co., Ltd., the in-feed conveyors are an important feature of the new conveyor system, their accommodation necessitating re-location to one side of two of the machines in each group. Neither of these, however, handles the bulbs, as one produces only the internal components, or pinch assemblies, and the other adds the filaments and support wires. The production operations require the bulbs to be held stationary at the various stages after leaving the main conveyor, and the stoppages to synchronize with those of the machines to which they are transferred. By means of a Whitworth drive, the in-feed conveyor is therefore operated intermittently by the first bulb-handling machine, known as the Sealex, having two turrets on which assembly of the lamps is commenced, including sealing, exhausting the bulbs, flushing them with nitrogen and gas-filling them with 90 per cent argon and 10 per cent nitrogen.

The transfer tables are slightly inclined and fitted with ball-bearing rollers. On arrival at a table, each tray of bulbs is lowered on to it by the lift at the higher end so that it moves by gravity towards the in-feed conveyor that crosses over the table above the centre line. The moving member of the conveyor consists of evenly spaced, centrally pivoted brass plates, the sides of which are cut away to form round apertures slightly smaller in diameter than the bulbs handled and spaced to correspond with the holes that support them on the trays. Below the tray level is a line of nine pneumatically operated cone-headed plungers. To unload a tray, these are raised so that they enter the lower ends of each row of bulbs on the trays and push them up between the plates which hinge up to admit them and resume their normal flat position to support them as the plungers are withdrawn.

Pneumatic equipment is also used to index the movements of the trays down the table, so that each line of bulbs is held stationary while the plungers are applied. Under the two outer edges of each tray is fitted a line of pegs,

Fig. 5. A loaded tray on a transfer table, with the first row of bulbs raised by pneumatic plungers on to the in-feed conveyor. On the right is seen the crown imprinting machine in operation

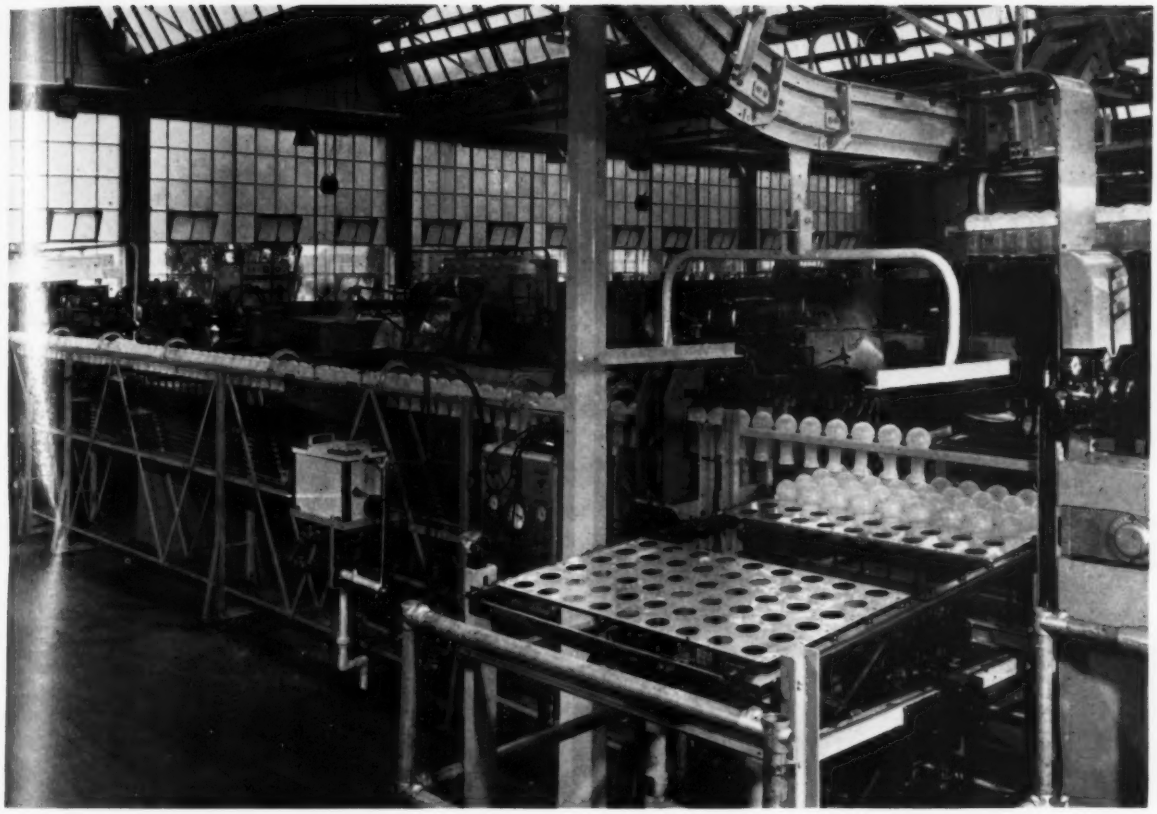


Fig. 6. An empty tray in position on the transfer table ready to be raised by the lift below on to a passing hanger. To the left of the table is the new bulb washing and drying equipment

3½ in apart and aligned with a pair of pneumatically operated stops mounted $1\frac{3}{4}$ in apart below the table on each side. As each loaded tray moves down the unloading position it passes over the first stops on each side, as they are lowered clear of the pegs, but is brought to rest at half-index by the next stops, which are raised to obstruct the first two pegs. These stops are then lowered and the others simultaneously raised so that the tray moves a further $1\frac{3}{4}$ in and is halted at full index by the stops obstructing the second two pegs. This is repeated six times, and the tray now empty, is released and moves down to the far end of the table.

Pneumatic operation of the stops and unloading plungers is controlled by micro-switches actuated by three pegs on the side of a sprocket over which the in-feed conveyor is passed. Two of these control an electrically operated valve which, through pipe connections, admits air pressure alternately to the ends of a cylinder as each switch is closed, thereby moving a piston in one direction or the other. Each pair of stops on either side of the transfer table are mounted on the upper ends of vertical racks engaging with a pinion between them. One of each pair of racks is connected by a system of linkages and levers to the piston so that it is raised or lowered by its movements, thereby rotating the pinion which at the same time respectively lowers or raises the rack on the other side. These movements are timed so that the tray is at full index when the conveyor is stationary and when, at its every ninth stoppage, closure of a microswitch by the third peg causes the unloading plungers to operate.

When an empty tray reaches the end of the transfer table, it operates a switch that releases the air supply to the lifts; if no tray is there, the supply is cut off and both lifts are inoperative. This is an essential safeguard against tray collision when a loaded tray approaches a transfer table while the bulbs on a previous one are being unloaded on to the in-feed conveyor, due, as previously mentioned, to the latter's rate of acceptance being slightly lower than the feeding rate of the main conveyor. Another safeguard is an interlocking valve which normally cuts off the air supply to the empty tray lift but is connected to that supplying air pressure to the other lift and is opened by it immediately the latter is energized.

On leaving the transfer table the bulbs are stopped in turn and, after stamping, returns them to the conveyor. They are then automatically counted and pass through a new plant by which they are washed internally by jets of hot demineralized water, drained and dried by hot air. An important advantage of this new machine group feature is that the bulbs, while thoroughly clean and dry, though still hot, are quickly transferred from the conveyor to the processing machines. The presence of dirt or condensation on the inside of the glass has an adverse effect on the life of the lamps as might be the case after waiting a considerable time for delivery by hand, particularly when the machines are shut down during weekends or other long periods.

Belt and chain conveyors take the lamps to and from the final processing machines and, when completed, they are tested before being fitted into their cases. They are then deposited on to a short conveyor to be hand-packed into cartons. A belt conveyor running alongside the ends of the production groups carries the cartons to the inspection area from which they are lowered by chute to storage on the first floor.

HANDLING MILLED PEAT AT POWER STATIONS – PART 1

by A. G. Kelly, B.E., A.M.I.Mech.E., M.A.S.M.E., and S. F. Coakley, B.E., B.Sc.*

Fig. 1. Ferbane Power Station Plant viewed from top of boiler house

THE handling of milled peat at power stations requires a plant to carry a volume of 12 times what would be required for a coal-burning station. The first stations of the Electricity Supply Board of Ireland to utilize this fuel are 90, 80, and 60 MW capacity. The peat arrives at the station in light wagons of a type dictated by bog-surface conditions; a rotary tippler is employed to discharge them.

Two schemes of feeding 40 to 60 wagons/hr through the tipplers have been evolved (*a*) using gravitational feed where plain three-link wagon couplings are used and (*b*) using an uphill gradient where wagons are permanently connected by swivel link couplings. Two schemes of holding wagons during tippling have also been evolved; one where hydraulically powered clamping bars hold the wagon, and one where the clearances between the wagon frame and the wagon are set such that no clamps are required.

Hoppers and bunkers containing milled peat must have sides to particular slopes for satisfactory discharge. Extraction of fuel from bunkers has been by scraper conveyors or steel plate conveyor.

This article presents the techniques adopted in the power stations of the Electricity Supply Board of Ireland for handling peat, and also some description of the economic and engineering considerations that led to their adoption and of the operating experience to date. It covers the plant commencing at the point where the peat is delivered in wagons at the power station site by the peat supply authority, (Bord na Mona), to the point where the peat is finally delivered to the boiler mills for P.F. firing.

Only when the nature of the fuel, the type of wagon being handled, or the throughput, has given rise to special considerations have any details been given; those parts of the plant that are orthodox, and as such amply described elsewhere, are not specifically described.

The problem of handling milled peat at the power stations is one of unloading, transporting, sorting and feeding the fuel to the pulverizing mills. The design work and original thinking necessary to overcome the special problems arising from the use of milled peat as a new fuel, and in adopting existing techniques to the particular requirements of this fuel, were carried out by the Electricity Supply Board, in conjunction with the various suppliers of the plant over the last seven or eight years.

Quantity of Milled Peat Required for Power Generation

Allowing for the worst condition of fuel, it can be shown that the handling plant in a milled peat station must have approximately 12 times the volumetric capacity of a coal-fired station of equal output, and approximately 4·5 times the capacity of weight.

If we assume an overall efficiency of 25 per cent the quantity of milled peat required per hr for an 80 MW station on full load would be approximately from 110 to 180 tons/hr, or 10,000 to 22,000 cu. ft./hr delivered to the boiler, the higher figures covering condition of poor quality, high moisture content fuel.

Siting of Station

The milled peat stations were sited for the usual considerations of cost of transport of fuel, cooling water availability, ease of access, suitability of ground for foundations, electrical connections to the system, etc. In view of the bulk of fuel to be transported, this consideration was the most important and all the stations have been located by the bog, as near as possible to the centre of gravity of the peat supply. This has necessitated the use of cooling towers for condenser cooling on the turbo-alternator sets on all stations built to date. Shannonbridge Station, however, will have ample cooling water supply from the river Shannon.

Various schemes were considered for getting the fuel out of the rail piles on the bog in which it is stored to a station site, and the one finally adopted is as follows:—A 3-ft gauge

*Power Station Design Engineers at the Electricity Supply Board of Ireland.

Fig. 2. Map showing the location of the Ferbane Power Station relative to its supply bog

railway system using diesel locomotives pulling a rake of 10 to 14 wagons takes the peat from the loaders to the station site.

Fig. 2 shows a map of the location of the Ferbane Power Station relative to its supply bog. The relative locations of the other stations to their bogs is somewhat similar.

Milled Peat Wagons

A typical wagon used by Bord na Mona is shown in Fig. 3. The capacity of each wagon is 565 cu. ft. (16 cu. metres); each wagon is completely lined with aluminium sheeting. The wagons are mounted on two 4-wheeled bogies, each bogie supporting the wagon by means of a single centrally positioned cup and pin. This means that the wagon is supported on a cup fore and aft. Small rollers are fitted to the end frame of the wagon body on each side of the support pin, above one of the bogies and engaged on plate on the bogie. The wagon sits free of the other bogie with skid plates that only make contact when the wagon body leans over by an appreciable angle to the bogie. This arrangement allows the wagon body appreciable freedom on the bogies for negotiating irregular track on the bog. In arriving at this design, full consideration was given to the alternative possibility of using saddleback wagons (as used at the Lullymore milled peat briquetting factory), also side or bottom opening types of various designs. However, this wagon was selected mainly due to considerations of rail conditions existing on the bog and the difficulty of ensuring flow of milled peat of high moisture content from the other types. The use of this type of wagon dictated the adoption of rotary tipplers at the station.

Overall Scheme

Fig. 4 shows an approximate flow sheet for the fuel from the time of harvesting to when it enters the boiler pulverizing mills. This shows the interdependence of the related sections in the cycle and shows what considerations led up to fixing the capacity of each part of the plant.

For the purpose of this flow diagram a typical set-up has been taken to give 80 MW gross output at the power station. The figures have been reduced to a 55 per cent moisture content basis. It can be seen that 700,000 tons of fuel are harvested in a typical year, the harvesting season extending about 4 months per annum. The peat surplus to the immediate needs is stored on the bog; the maximum storage in an average year would be approximately 600,000 tons.

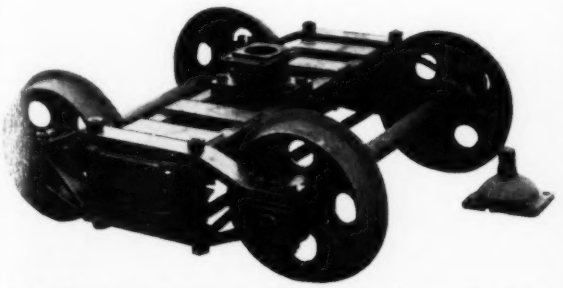
What is required at the station is a controllable supply of fuel from 0 to 180 tons/hr feeding the mills. This supply must be as reliable as possible consistent with reasonable investment, and with this end in view it has been the policy to install a bunker from which the mill feeders can draw their supply. This bunker has two purposes, (1) to allow the station to operate with one-shift or two-shift loading on the bog, and (2) to act as an emergency storage so that a continuous supply can be kept to the mills, even when any part of the cycle between the bog and power station breaks down.

From the bog storage the fuel is fed by loaders into the wagons which are either brought to a marshalling yard at the station site or brought direct to the tippler. The marshalling yard helps to smooth out delivery to the station and also acts as storage, the aim being to fill the yard with full wagons before stopping the day's loading; these full wagons and those left full on the rail before the tippler is taken into consideration in sizing the station bunkers so they can be used as required. A shunting locomotive can be employed to bring in wagons from the marshalling yard to the tippler at night-time or on days on which no deliveries are made from the bog.

At the station site the wagons have to be marshalled in and presented to the tippler, and after tippling marshalled out, and returned to the bog. Small bunkers are placed under the tipplers to smooth out the flow from the intermittently tippled wagons to the constant running belt system.

The flow diagram also shows a blending bunker, further details on which are given below. This bunker would represent additional storage on the station site. An outdoor storage is also shown which could be used in much the same way as a stockpile of coal at a coal station.

It could be argued that the system adopted is neither



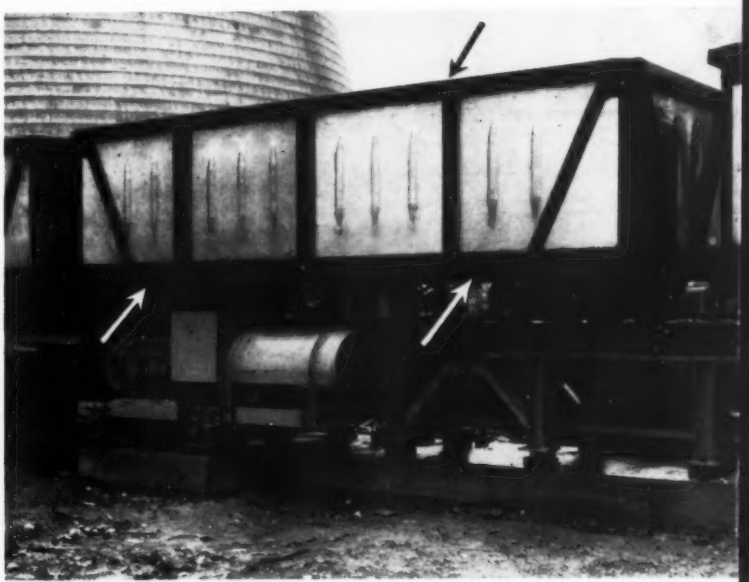


Fig. 3. 16 cu. m. milled peat wagon (a) (right) side view; (b) (above) detail of bogie

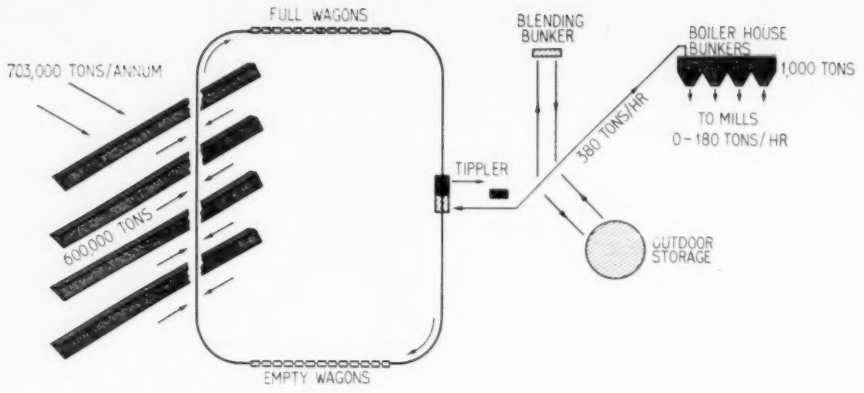


Fig. 4. Flow diagram for typical set-up giving 80 MW gross output at the Power Station

national nor economic. As already stated, what is required is a controllable supply of fuel to any or all of the pulverizing mills situated in the basement of the station. If a continuous and absolutely reliable feed from the bog could be established then each link in the supply chain would be matched to the mill capacities and the point of fuel application at the station would be at the inlet to the mill chutes, about 20 ft above basement level. This point was taken as about 40 ft above basement level before experience in the burning of milled peat was obtained; this was because mixing of peat and recirculated hot gas at that level for predrying before milling was thought to be an advantage. However, this is impossible and storage has to be installed as near as possible to the mills. Once this is accepted then the point of application moved from 20 ft to more than 100 ft above basement level and all links in this supply chain before the storage have to be increased in capacity and run intermittently. Once storage is accepted, it becomes economic to have a larger bunker than might be considered purely for reliability since it may allow single or double shift loading on the bog or operation of the feeding supply chain.

It is by following the philosophy of reliability in accordance with normal power station practice and taking into consideration layout and the cost of plant, that the capacities of the plant installed have been derived.

The overall scheme of fuel handling was in agreement between Bord na Mona, which supplies the peat, and the Electricity Supply Board which uses it. Various schemes were considered, viz., wagons lifted by crane and tipped into overhead bunkers, aerial ropeways delivering from bog and rotary tipplers emptying surface wagons delivering the peat via belts to overhead bunkers. The latter was chosen on the score of being the best from the point of view of capacity, reliability and cost.

Feeding Wagons Through Tippler

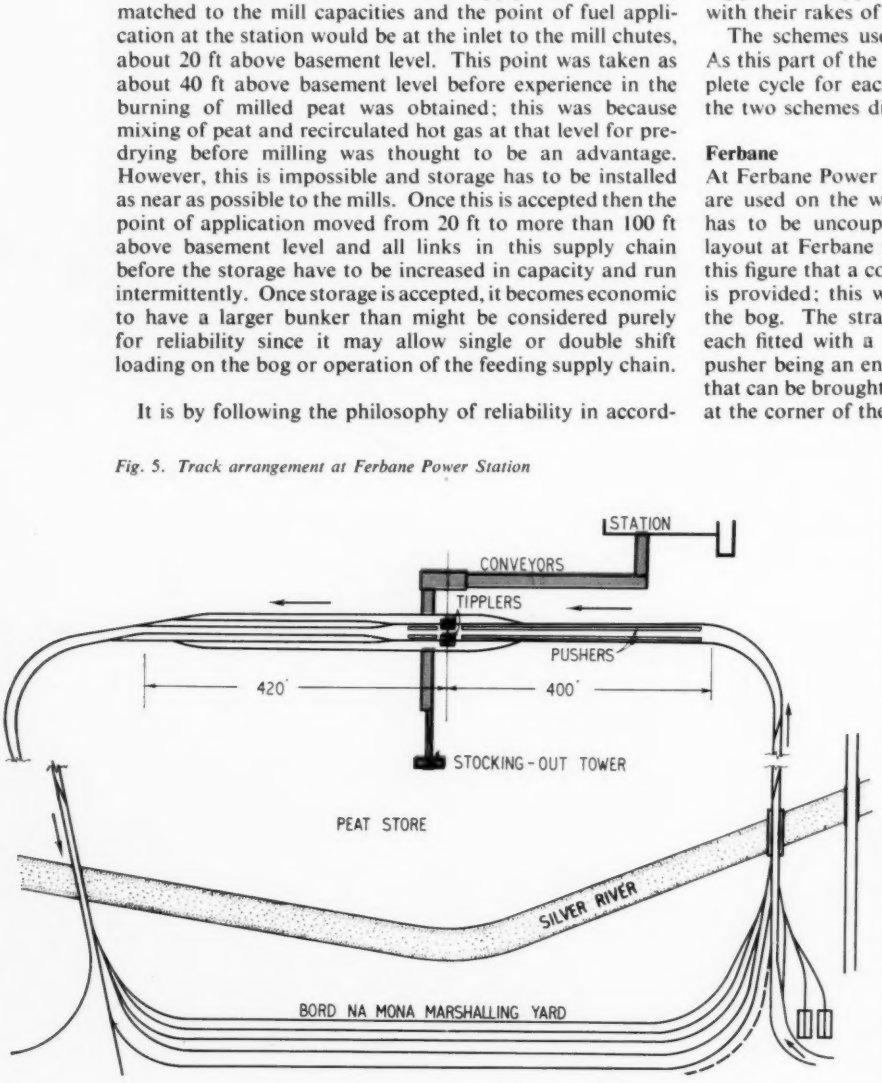
The required 40 to 60 wagons/hr are brought from the marshalling yard of Bord na Mona to the station site by either (*a*) shunting locos operating between the marshalling yard and tippler or (*b*) the main bog locos running direct with their rakes of wagons to the tippler.

The schemes used at Ferbane and Rhode are different. As this part of the plant is particularly interesting, the complete cycle for each is described below, and the merits of the two schemes discussed.

Ferbane

At Ferbane Power Station straightforward 3-link couplings are used on the wagons and this means that each wagon has to be uncoupled before tippling. The general track layout at Ferbane is shown on Fig. 5. It can be seen from this figure that a complete circular track through the tippler is provided; this was dictated by the approach lines from the bog. The straight tracks leading into the tippler are each fitted with a mechanical pusher of 370 ft length, the pusher being an endless chain on which are mounted heads that can be brought up by hand to engage on plates situated at the corner of the wagon.

Fig. 5. Track arrangement at Ferbane Power Station



The speed of the pusher can be adjusted from 12 ft/min to 36 ft/min by the use of 'P.I.V.' gears. The wagons are either uncoupled by hand before the pusher is engaged on the last wagon of a rake or else a rod is used while the wagons are moving slowly along the pusher. The tipplers are also provided with short pushers on the discharge side, running at a constant speed of 100 ft/min.

Fig. 6 shows the track arrangement through the tippler as originally planned. The operation of the cycle is:—

The rake of wagons is either pulled in by loco on to the track in front of the tippler, the loco escaping by means of the track by-passing the tippler; or else the wagon rake is pushed in by the shunting loco from the marshalling yard, the loco reversing out, leaving the wagons in front of the tippler. The last wagon of the rake is now engaged by a manually lifted buffer on the pushing-in device.

When the first wagon of the rake

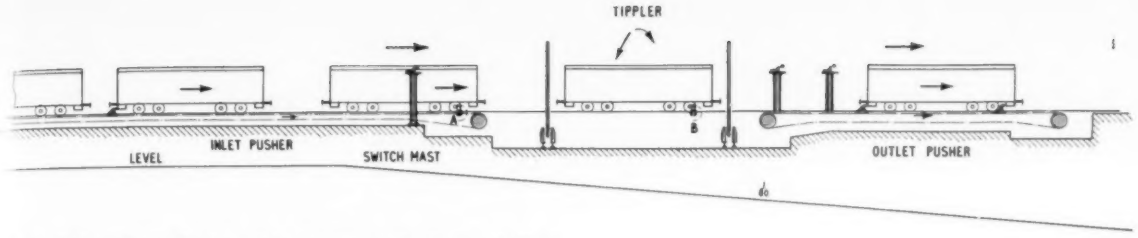


Fig. 6. Ferbane Power Station track arrangement showing marshalling through tippler

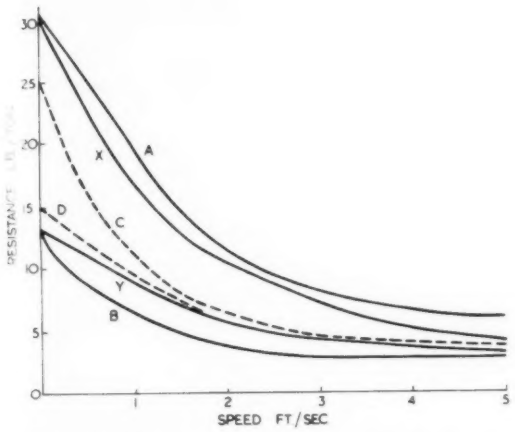


Fig. 7. Rolling characteristics of wagons between A and B limits for all normal wagons. X and Y limits for approximately 80 per cent of wagons. C and D limits for approximately 60 per cent of wagons

reaches the top of the incline before the tippler it breaks away from the remainder and runs under gravity down into the tippler and is arrested by the wagon stops 'B' Fig. 6, which are in the up position. These wagon stops act on the front axle of the wagon. This wagon on its way into the tippler trips certain relays that are positioned on masts in front of the tippler, along the top clamping bars in the tippler and on the rails. These relays cause the wagon stops 'A' in front of the tippler to come to the 'up' positions as the last axle goes over them, thus preventing a second wagon fouling the first while it is being tippled. The relays also activate an adjustable time relay which is set to match the desired speed of tippling and will trip the pushing-in device, preventing the second wagon from being pushed on to the stops 'A' whilst these are in the 'up' position if there is undue delay in clearing the first wagon.

Another function of the relays is to initiate automatically the clamping and tippling of the first wagon when it comes to rest against stops 'B'. When the first wagon has been tippled and unclamped, the wagon stops are returned to the down position. The first wagon is now ready to run out of the tippler under gravity and if the pushing-in device has been set correctly the second wagon should be breaking away from the remainder of the wagon and will enter the tippler as the first one moves out. The empty wagon on leaving the tippler again trips certain relays that bring the wagon stops 'B' to the up position as its last axle passes over them, thus arresting the second wagon in the tippler, and so the cycle continues.

The purpose of the short pushing-out device is to ensure that the empty wagons will clear the points behind the tippler and enter one of the marshalling sidings where the empty wagons are stacked by gravity ready for re-coupling.

The timing of the tippling cycle is approximately 30 to 35 secs for clamping, tippling, unclamping, and re-aligning of the tippler, 25 to 30 secs for one wagon rolling out and the next in. A capacity of up to 60 wagons/hr has been achieved, though for normal running 50 wagons/hr is ample.

The capacity required for these tipplers necessitates fully automatic control. For automatic control each motion of the tippling cycle has to have associated with its drive motor a relay which starts it when the previous motion in the cycle has been completed and another relay to stop itself has completed its function. It also means a number of safety interlocks between the various drives to ensure that the tippling cycle will be stopped if any part of the cycle has not been successfully completed.

The type of relay used is totally enclosed and is activated by an arm operating through a dustproof gland. These relays have, so far, given no trouble.

The above method of operation was not completely successful in service for the following reasons:—

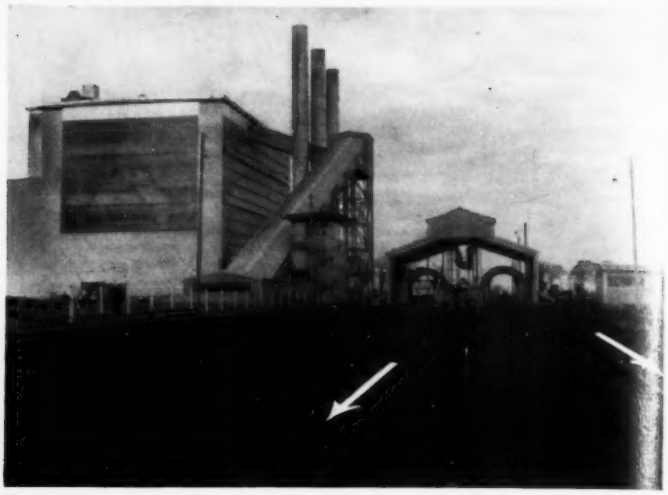
(*a*) The following characteristics of the wagons are shown in Fig. 7, from which it can be seen that the rolling resistance varies considerably from one wagon to another and is also very much dependent on speed. The wagons are fitted with roller bearings but the wheel tyres are not machined in the case of Febane.

(*b*) The wagon stops are shown in Fig. 8. It is difficult to design a stop that will absorb the energy of a wagon weighing up to 10 tons without undue shock and without bounce. Also the stops in the tippler have accurately to position the wagon, i.e. must have approximately the same energy-absorbing stroke for all speeds of wagon approach.

To ensure that all full wagons roll into the tippler, the slope through the tippler had to be such that free running ones picked up appreciable speed. This caused failure of the

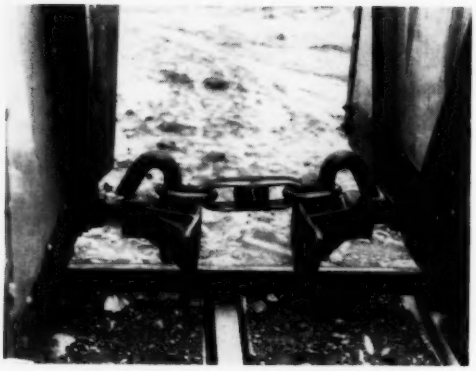
Fig. 8. Wagon stops before tippler Ferbane Station

9



10

Fig. 9. Rake of wagons on pusher before tippler at Ferbane Station
Fig. 10. Gravity marshalling yard Ferbane Power Station slope of 1:200
Fig. 11. Rotary swivel couplings



11

wagon stops, the drive gears being stripped, even after the addition of an extra magnetic brake in the buffer shaft. To overcome this, the slope was lessened and a slight hump was placed in the track in front of the first sets of wagon stops. This means that stiff wagons have to be pushed right up to the tippler by the pushing device, also the pushing device runs intermittently, stopping for short periods between most pairs of wagons. However, by running the pushing device at fast speed the full rate of 50 wagons per hour is still achieved.

Due to the rolling characteristics of the wagons, trouble has been experienced with the gravity marshalling of the empty wagons. There is no slope on which the wagons can be said to run at anything like constant speed. The stiff ones decelerate and stop, while the free-running ones accelerate and reach a speed of 10 ft/sec. There is a doubt that the buffers on the wagons are able to absorb enough energy to avoid damage at this speed. This difficulty is common to all gravity marshalling yards and is usually solved by having brakes fitted to each wagon operated by men riding with the wagons, or else a complicated system of remotely controlled rail retarders. There are designs of wagon retarders working with hydraulic cylinders with adjustable bleeds for placing along the tracks in a gravity marshalling yard; however, we have not found one to give the required characteristics.

These two problems are being investigated and it is hoped that suitable retarders for the marshalling yard and stops for the tipplers can be developed.

Fig. 9 shows a rake of wagons on the pusher before the Ferbane tippler, and Fig. 10 the gravity marshalling yard for collecting the empty wagons after tippling.

Rhode

The Rhode scheme differs basically from that used at Ferbane in that swivel couplings are employed between wagons—see Fig. 11. The swivel coupling comprises a swivel link with two plain links, one at either end; the buffer pins are of special shape devised for this particular application. The assembly must be capable of considerable flexibility, both vertically and horizontally—to negotiate the very uneven bog track; it must also be satisfactory for tippling at high speed. A standard Hudson swivel link is employed; this is a manganese steel link with a solid central pin without bushing.

To ensure positive positioning of the wagon in the tippler and of the wagons immediately before and after the tippler, the following scheme is employed. The rail leading to the tippler is on an up-slope. Three stops (*a*), (*b*) and (*c*), Fig. 12, and which are projecting up between the rails at all times except when knocked down momentarily by passing wagon pusher plates, are situated at defined spacings so that when the wagons roll back downhill they are held in definite positions. These positions are such that the swivel links between the three wagons in question are not in tension or too slack. The slopes of the track are computed from two considerations: (*a*) so that the normal bog locomotive is able to pull a 14-wagon rake up the slope under all conditions and (*b*) so that the wagons are guaranteed to roll back against the stops at all times, even with a tail wind blowing.

This scheme of using stops to position the wagons gives very smooth operation without shock on the wagons. The alternative of employing a level track with pistons rising from under track level or brakes to stop the wagon at defined positions, is not as satisfactory; these give rise to shock on the wagons due to the arresting of their motion and due to the consequent shudder which oscillates up and down the rake of wagons. The other alternative, i.e. using

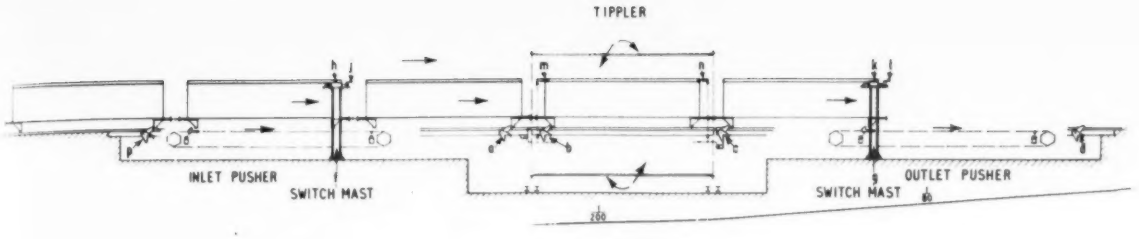


Fig. 12. *Rhode Power Station's track arrangement showing marshalling through tippler*

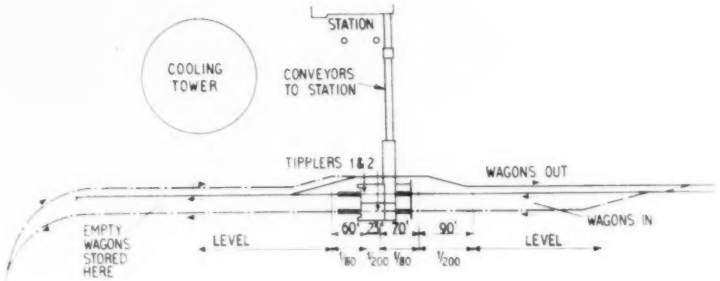


Fig. 13. Track arrangement at Rhode Power Station

a down-slope, is not feasible, because the rake would tend to run away when most of it had been tippled.

With the swivel couplings an advantage is that a short pusher is possible because pushing can be on the wagon seconds before the tippler. The Rhode pusher is 27 ft long.

Discharging of the rake of wagons is undertaken from the control cubicle situated between the present tippler and the site for the second one. This cubicle contains a console-type desk on which are situated the controls for starting the pushers and the tipplers. From his position at the desk the operator can see the position of the wagon in the tippler and the wagon coupling. Lifting in the area is sufficient for round-the-clock operation. The pushers and the tippler are interlocked so that the tippler will not operate while the pusher is in operation. There are also on the side of the tippler drum switches (*m*) and (*n*) Fig. 12 which will not allow of tippling if a wagon is not exactly situated in the tippler; the passage of a locomotive only will not allow of tippling because the inlet switches must be actuated before the control circuit is operative, due to the locomotive being narrower than a wagon; these consist of rollers at the inlet and outlet sides of the tippler drum which are depressed by a passing wagon and which make a contact in the control circuit. The tippler operation is not interlocked with the remainder of the system as the hoppers beneath the tippler can take peat even if the belt system stops. The tippler operator can see the peat in the underground hopper and knows when he should not operate.

The fact that swivel link couplings are used means that the rake of wagons can remain permanently tied together on the complete cycle. The rake arrives at the station with its locomotive in front. It proceeds until the locomotive has just passed through the tippler and the first wagon is in the tippler. The loco then de-clutches, allows the rake to settle against the stops, unhitches and goes on to collect the previous rake.

When the locomotive has departed the first wagon is in the correct position for tippling because it has relaxed against the stop (*b*) Fig. 12, which holds its back pusher plate; also the second wagon has relaxed against the stop (*a*) which acts on its front pusher plate. The operator now operates the control switch which sets the tippling cycle in motion. The slow-speed motor firstly comes into operation, and then the high speed, the point at which the high-speed motor takes over is adjustable and is set between 5 deg and 25 deg angle of turn to give the speed which just satisfies the required rate of discharge of wagons. A change from high speed back to slow speed is effected at about 340 deg to allow of easy positioning of the tippler in its end position at which position the operator is free to operate the inlet pusher.

The centre of rotation of the tippler is at the centre of rotation of the swivel link. Tests to see if this can be modified by having the centre of rotation higher with a consequently smaller diameter tippler, as at Ferbane, are scheduled. From the limited operation to date at Rhode it appears that this could be satisfactorily achieved due to the great flexibility of the wagon coupling employed.

The switch masts (*f*) and (*g*), Fig. 12, have each two switches; these are arranged such that when a wagon edge is between the two the control circuit is operative; the tippler position switches (*j*) and (*l*) are such that if a wagon

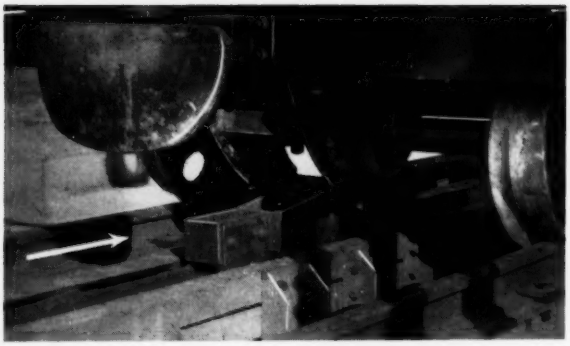


Fig. 14. Pusher head operating on wagon

is opposite any of them the control circuit is broken; the switches (*h*) and (*k*) on the other hand must have a wagon opposite them before the adjacent pusher is operative.

Thus, as seen from Fig. 12, all wagons which are critical for proper turning of the wagon in the tippler must be properly positioned before the operator can turn a wagon.

The operation of the control switch on the operator's desk for the inlet pusher now brings its cycle into operation. This consists of the pusher head coming around behind the projecting pusher plate beneath the wagon, Fig. 14, where it stops; the operator then starts it off at a high speed of 40 ft/min; then it changes to low speed, 12 ft/min, shortly before it disengages from the pusher plate by going down over the return sprocket to go to its starting point in preparation for the next cycle; this slowing down is to allow the wagons to stop accurately where required. Meanwhile, the wagons which were pushed some short distance beyond where their pusher plates crossed over the stops (*a*) and (*b*) and (*c*) roll back against those stops. The remaining wagons of the rake are connected and also roll back down hill. The distance involved, being from a few inches to a foot, does not allow of any speed developing and consequently no shock is put on the wagons.

At this stage the second wagon is in the correct position for tippling; this is the exact situation depicted in Fig. 12. The first wagon which has been pushed out beyond the tippler has relaxed back against the third stop (*c*). This procedure continues until the last wagon is standing before the tippler. At this stage the inlet pusher will not push this last wagon into the tippler. The switch mast (*f*) now has the inlet pusher-control circuit broken because no wagon is opposite the first of its switches (*h*), however, the mast (*g*) on the outlet has a wagon in the correct position to complete the control circuit. An outlet pusher similar to the inlet one is used to discharge the last wagon and to push the empty rake up the track in preparation for the arrival of the next rake. A further stop (*d*) keeps the empty rake from rolling back towards the tippler. The up-slope on the outlet track is such that the wagons will not move, even with a strong tail-wind.

The pusher-control circuit is arranged such that for each wagon except the first and last to be pushed in a rake, the pusher head on the inlet pusher comes around directly behind the pushing plate of the next wagon to be pushed without stopping beneath track level. When the last wagon to pass any pusher has been pushed away, the pusher head this time stops under track level so that it will not foul a locomotive passing by; the pusher head is not of the type that can be knocked down by passing axles.

The locomotive which had brought a rake of wagons into the tippler has already proceeded up the track, and connected to the previous rake which is standing resting against the stop (*d*) described above; it pushes that rake beyond the return switch and then pulls the rake back out to the bog. No shunting to get the locomotive in front of the rake is necessary. The timing of the cycle is:

Pushing in	45 seconds
Tippling	25-33 seconds (adjustable)
Allowance for inspection	12-20 seconds
Total	90 seconds

The pushing out of one wagon is simultaneous with the pushing in of the next one and is thus zero extra time. A safety stop (*k*) is positioned before the inlet pusher and is equipped with a heavy spring to arrest the rake of wagons should it, for any reason, get back from the operating stop.

The track layout in Fig. 13 for Rhode shows the present development and the future extension scheduled for completion in 1963. It is seen that the track layout on the discharge of No. 2 tippler allows the rakes returning to the bog to pass above the rakes standing on the discharge side of No. 1 tippler. It will also be seen that the Rhode track layout has a single line coming from the bog and a parallel one returning; this obviates the necessity of a roundabout at the station and is possible because of the favourable network of rails on the bog. The slopes used at Rhode are seen in Fig. 13.

The use of the scheme described above has the following advantages:—

(*a*) No uncoupling and recoupling of wagons is required, with consequent saving in manpower.
(*b*) The required throughput of 40 wagons per hour is more easily attained because there is never any delay in getting the next wagon into position.
(*c*) No buffeting of wagons occurs.
(*d*) A cheaper pusher and less length of track on the outlet side of the tippler are involved.

On the debit side are a slightly more expensive tippler because of its larger diameter to get the centre of rotation at the centre of the swivel link, a wagon coupling which is more

Fig. 15. Clearances from tippler to wagon frame and wheels at Rhode Station

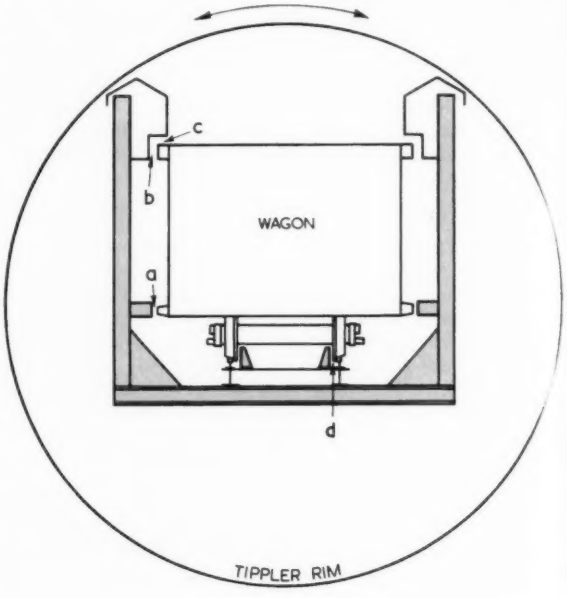


Fig. 16. Ferbane tippler viewed from outlet side. **A**—*vertical clamp;* **B**—*horizontal clamp (upper);* **C**—*horizontal clamp (lower); and* **D**—*wagon stops in 'up' position*

expensive, and the difficulty of disconnecting wagons one from the other should this ever be necessary.

The advantages outweigh the disadvantages in capital cost and operation and maintenance costs.

Clamping

As explained above, when tippling, both the wagon body and bogies have to be held and also the wagon must be carefully handled as it is of a light construction; no weight must be put on the central bogie pins which connect the wagon body to the wheel carriages. Since the amount of capital tied up in the wagons is very large compared with that tied up in any single item of fuel handling plant at the station, the overall design for the wagon is largely dictated by consideration of conditions on the bog. Hence the aim has been to design the fuel handling plant to cater for the wagons rather than try to modify the design of the wagon. The only special attachments dictated by the tippler have been:—

(*a*) the use of rotary swivel couplings at the stations after Ferbane,

(*b*) pusher plate for mechanical marshalling,

(*c*) clamping bars along the sides of the wagon for mating with the tippler mechanism.

The possible methods considered to hold the wagon in the tippler drum were as follows:—

(1) Fig. 15 shows the arrangement with no moveable clamps, that is, the tippler drum is provided with fixed bars and guides which are positioned with the minimum possible clearance to the sides and top of the wagon and from the inside of the wheel flanges. These have been calculated as a result of a series of tests on wagons to ascertain what the likely deformation will be over a number of years. The clearances used, as seen in Fig. 15, are such that (*a*) no weight is thrown on the bogie pin or wheel flanges and (*b*) the wagon body has not far to move to rest against the stops, thus resulting in smooth operation without undue shock. The fixed guide bars against which the top edges of the wagon body rest are timber or rubber faced. While the tippler is turning, the friction force against the clamping bars prevents any axial movement of the wagon. This method is used at Rhode and will be used at Bellacorick.

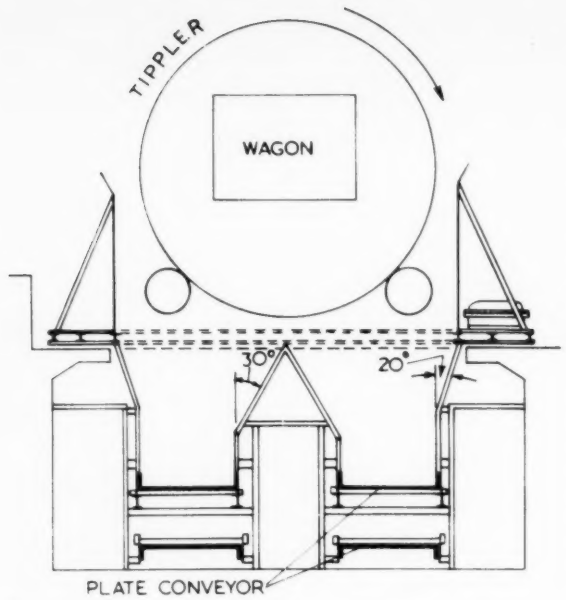
(2) It would be possible to use mechanical clamping, the clamps being held clear of the wagon by springs when the tippler is in the rest position, these springs being relaxed by means of cam-operated levers operated from cams outside the tippler drum as soon as the tippler starts to move. This method has not, so far, been used in any of the E.S.B.'s stations.

(3) At Ferbane the wagons are hydraulically clamped along their complete length; the clamps can be seen in Fig. 16. The clamps press down on top of the long sides of the wagon; then further side clamps move horizontally to press against the top and bottom of the wagon sides—the mating surfaces on the wagons will be seen on Fig. 3(*a*).

The oil pressure is provided by a special type of swash plate pump mounted on the tippler, the oil being distributed through an electrically operated valve mechanism. This necessitates having an electric motor for the pump, small auxiliary motors for the clamping mechanism, safety valve contacts, etc., on the tippler drum. The electrical supply is fed to the drum by means of a counter-weighted trailing cable. This trailing cable also carries all the control connections for interlocking the various steps, in the tippling cycle both for clamping and for spotting the wagon. The hydraulic clamps come in before the tippler drum starts to move and relax when it comes to rest. These clamps undoubtedly handle the wagon very carefully from the point of view of wagon wear and are very satisfactory in operation. However, they are rather expensive and complicated, necessitating a number of electrical drives and finely adjusted mechanisms on the tippler drum.

Tippler Drive

Regarding the drive of the tippler drum, to handle the wagons carefully and to give the required throughput it is desirable to have two speeds, that is, a slow speed at take-off and when coming to rest, and a fast speed for the remainder of the turn. This means two motors and the necessary controls; however, it saves time on the actual tippling and allows a simpler locking device to be used for positioning the tippler drum in the rest position. The tipplers installed at Ferbane and at Rhode are supported by four driving wheels which turn the tippler by friction on two rims placed fore and aft on the tippler drum. All four wheels are driven. Some trouble was experienced at Ferbane, particularly



17a

17b

Fig. 17. Hoppers under tippler (a) Cross section showing hopper slopes; (b) Rhode looking down on plate conveyor

during wet weather, due to peat dust briquetting on the rim and causing the driving wheels to slip. This trouble was also experienced during frosty weather due to ice build-up on the rim. However, both these troubles were overcome by use of scrapers and wire brushes fixed to the tippler frame which keep the rim permanently clear.

At Bellacorick, gear drive at only one end of the drum is being used; the teeth on the drum meshing with the gear drive will consist of rollers with spaces between them to ensure that fuel cannot be trapped. It has been the experience that where chain drives are used in locations exposed to severe conditions of peat dust, satisfactory operation is achieved only by the use of liberal application of grease. Where exposed gear drives are used it is necessary to provide a cover to prevent peat dust becoming briquetted between the gears. The tippler drum is in all cases counterweighted so as to keep the average out-of-balance to the minimum.

Covering Over Tippler

The two tipplers at Ferbane are housed under an open-ended cover—see Fig. 10. This covering has proved useful as a protection against the weather at the tippler and to allow maintenance to be done on the tippler during winter. The tippler at Rhode will be covered by a simpler type of cover, possible because no trailing cable with its attendant feed drum is required.

Hoppers Under Tippler

Each tippler at Ferbane and Rhode is fitted with a twin hopper, each side having a capacity equal to approximately three wagons. The hoppers are shown on Fig. 17 and are made with mild steel plating. The angles of the sides are as shown in the drawing and no trouble whatsoever has been experienced due to arching. The hopper is graded to be narrower at the back than at the front; this is to ensure even emptying by the plate conveyor which forms the bunker bottom. This grading has achieved its object. Twin hoppers are used to reduce the depth of excavation required. Alternate clockwise and anti-clockwise rotation of the tippler allows even filling.

Method of Discharging Tippler Hoppers

The hoppers under the tipplers are emptied by plate conveyors that draw the length of the hoppers, two being provided per tippler. The plate conveyors consist of connected trays that form a complete bottom to the bunker, these trays having interlaced sides to prevent spillage. The trays are supported on rollers and are pulled along under the hopper. Regulation of the amount discharged to match with the rate of tippling is achieved by the use of a guillotine door at the outlet from the hopper. The surfaces of the steel cells are flat, no scrapers being provided. These work satisfactorily and no sign of sliding under the fuel has been observed. The trays, once clear of the hoppers, are angled up at an angle of 25 deg (30 deg is used at Rhode), to allow the underground belt on to which they feed to be as high as possible and thus limit the depth of excavation necessary. No sign of the peat falling back has been observed and a very even flow has been achieved on to the belts. No appreciable fuel surges occur as each tray comes up to the driving head.

It has been found that the trays bring around a small amount of dust and deposit it at the tension end of the back of the hopper. This dust is caught between the plates as they go over the discharge head and is freed as the plates go over the tension end. This necessitates cleaning every few hours at the tension point. The installation of a cleaning conveyor beneath would have prevented this but would have made the excavation uneconomically deep when compared with the labour content employed on cleaning. One manufacturer claims that this problem has been overcome by special design of the overlap portion of the plates.

The working surface of the plate conveyors is cleaned by metal scrapers and no trouble with build-up has been observed. The steel cell conveyors are fitted with a very positive type of drive and no great tension is necessary. This has proved satisfactory. All greasing points have been brought out to the sides of the hoppers and no trouble has been experienced in greasing in the dusty atmosphere around the hopper.

(To be concluded)

MECHANIZED LIMESTONE QUARRY

Output of 400,000 tons per annum

In the centre of the magnificent highland scenery of Derbyshire where the plateaux are suddenly cut by limestone crags and richly wooded valleys are situated the Bowne & Shaw limestone quarries of Stewarts and Lloyds Minerals, Ltd., at Wirksworth. The known history of Wirksworth Quarry dates back to over 200 years ago and the extraction of the carboniferous limestone, of which there is an abundant supply, has proceeded ever since.

Owing to the increasing difficulty of maintaining the labour force necessary for operating the quarries by orthodox methods of manual drilling, breaking, handling and loading of material it was decided some nine years ago to make the quarry a fully mechanized unit. The contract for the crushing, grading, screening, handling and the loading stations equipment was placed with Ernest Newell & Co., Ltd., who acted as consultants and designers as well as the main contractors. Stewarts and Lloyds Minerals, Ltd., were responsible for the surveying and planning of the complete plant and also undertook the design of the electrical installation.

The plant has been designed to handle approximately 400,000 tons of limestone from the quarry per year, at the rate of 8,400 tons per week. The average weight of run of quarry stone fed to the crushing plant is 200 tons per hour.

The objective of this quarry is to supply crushed limestone of different gradings at three points: (A) at the road vehicle loading station incorporated with the screening house bunkers; (B) at what is principally a rail loading station (now also used for loading road vehicles) at the terminus of the conveyor system in the valley bottom; (C) At the lime kilns.

To comprehend this extensive layout, which occupies the whole of one side of an extensive cup in the hills, it is convenient to view it in the following parts:—

(1) Work on the quarry face and transport to the crushers.
(2) The crusher house.
(3) The screening house and road vehicle loading station.
(4) The railway loading house.

At the highest point, say 700 to 1,000 ft above sea level, is the quarry face. From this the raw material is delivered into the top of a primary crusher house mainly below the quarry floor level before travelling to the secondary crusher house again at a lower level. From this it is fed by inclined conveyor to the top of the screen house, at the base of which is the main conveyor, which passes under the public roadway to the valley bottom to meet the British Railways track. There is therefore a considerable fall in elevation from one end of the project to the other.

Quarry Face to Crushers

The face of the quarry is approximately 100 ft high and is

Fig. 1. General view of the Bowne & Shaw limestone quarries at Wirksworth

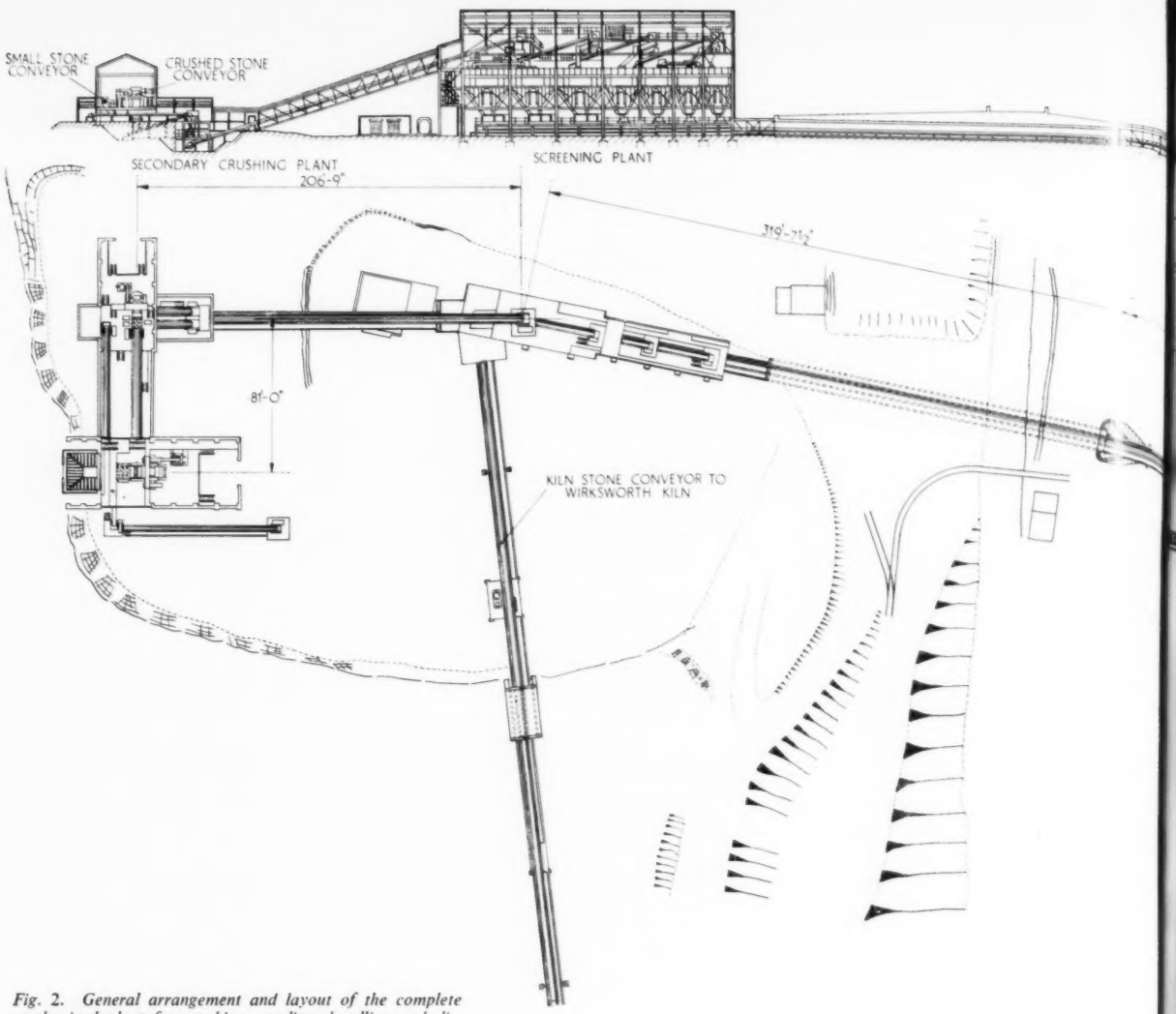


Fig. 2. General arrangement and layout of the complete mechanized plant for crushing, grading, handling and discharging limestone

worked progressively across two long bays. Blasting is kept ahead of requirements by about one month's supply, so that there is always a good stock of stone for the crushing and other plant. The stone is loaded on the quarry floor by a Ruston Bucyrus electrically driven 120RB forward-shovel excavator into the Eagle side-tipping dumpers. There are three dumpers in operation together and a fourth in reserve —the distance between the excavator and dumping hopper determining the number used at one time; one dumper is of 15 tons capacity and the others of 12 tons.

The dumpers take their load into a covered throughway situated at the end of the primary crushing house. When the vehicle is stopped at the correct position, the driver without leaving his cab presses a button attached to the crusher house wall which operates an electrically driven Heywood winch. As the drum begins to revolve a hook catches a bar protruding from the near-side of the dumper body, slowly raising it on to its side so as to discharge the load into the dumping hopper. At a predetermined point the winch is halted by a limit switch and on pressing a further button the driver reverses it and so lowers the body to its original position. The dumper then continues on its journey and returns to collect another load of stone.

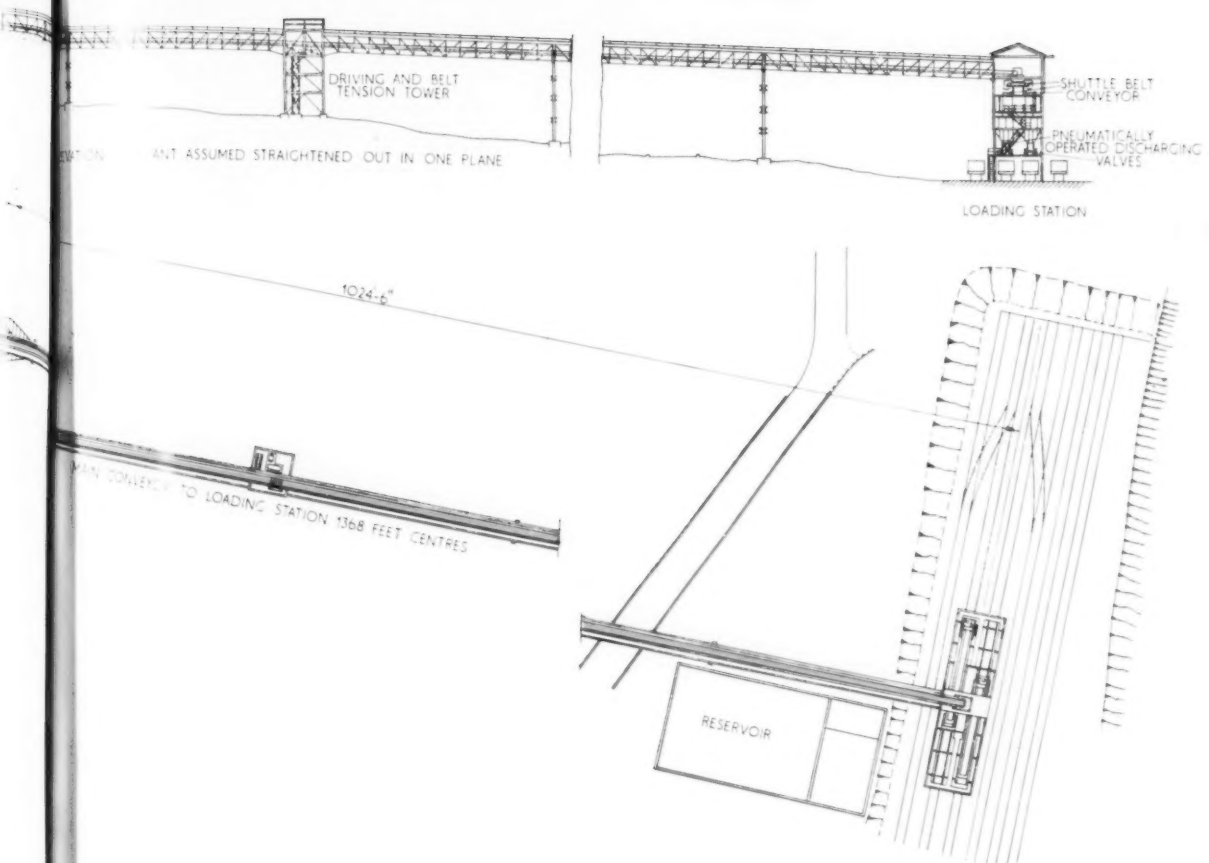
The hopper which receives the limestone from the dumpers is of particularly strong and rigid construction. In order to withstand the impact of 12 tons of falling stone the sides of the hopper are constructed of $\frac{5}{8}$-in steel plate bolted to steel joists which are embedded in concrete.

The Crushers

The primary crusher house is designed to provide three main streams in the following way: (i) material below 3 in; (ii) material above 3 in; (iii) material below 1 in regarded as waste.

From the dumping hopper the limestone is fed by a Hadfields pan feeder to a five-roll Hadfield grizzley screen which removes all material below 3 in. From 5 to 30 tons/hr of this material reach a hopper supplying a vibrating screen which removes all plus-1-in material. This is delivered by conveyors to a surge hopper in the secondary crushing house where it is joined by the product of the two crushers. Material falling through the vibrating screen is waste and is taken by conveyor to an elevated hopper situated outside the primary crusher house for removal by road traffic.

Stone passing over the five-roll grizzley screen is tran-



ferred into a Hadfield 72 × 48-in jaw breaker. Under this a reciprocating feeder set at right angles propels the stone from the crusher on to a 1½-in steel striking plate and then by a conveyor belt to the secondary crusher house.

A number of devices are incorporated to ensure correct production speeds and to prolong the life of the plant. Electronic control is provided to give an infinitely variable speed from zero up to 250 tons/hr, selected by a single knob operating through a Heenan & Froude dynamic coupling.

Impact idlers are fitted beneath the belt wherever stone falls on to a conveyor. To clean the belts on the return span there are scraper bars between the driving and snub pulleys.

At the secondary crusher house the following flow routes have been developed:—

(iv) Material (supplied from Stream (ii) above) which is greater than 7 in after secondary processing.

(v) Material (supplied from Stream (ii) above) which is less than 7 in after secondary processing.

(vi) Material below 3 in (supplied from Stream (i) above) which is delivered without further processing to the surge hopper.

The crushed stone above 3-in mesh is received from the primary crusher house on a 48-in belt and discharged in the secondary crusher house on to a three-roll grizzley in which each roll is driven by separate motors at different speeds. The first roll runs at a slow speed against the flow of stone, while the second and third rolls revolve with the flow and have the effect of lifting the stone out and over. To overcome any tendency the stone may have towards sticking, the third roll runs at a higher speed.

Stone below 7 in is extracted by the grizzley and is taken away by a 42-in belt conveyor and discharged into the large-capacity surge hopper. This conveyor also receives the stone extracted by the five-roll grizzley at primary crushing.

Stone not falling through the secondary three-roll grizzley is reduced to minus 7 in by a 42 × 30-in Hadfield secondary crusher. It is subsequently carried by a 42-in conveyor belt to the surge hopper, the collection point for the entire product of the quarry face, except the waste passing the 1-in vibrating screen at the primary stage. The stone at this point has either been through the two crushers or extracted by the two grizzleys.

A 48-in wide conveyor running at 206-ft centres is used to take the stone to the screening plant. An automatic deadweight tensioning gear keeps the tension of this belt constant, any sudden shock to the belt being absorbed by the vertical sliding action of a weighted pulley.

A tertiary crusher is located to one side of the secondary crusher and this is only brought into use occasionally when there is a strong demand for the smaller sizes of stone. Material is taken from the bins or stockpiles by truck, passed through the tertiary crusher and returned direct to the bins by conveyor.

The Screen House

The screen house of steel sheeting on a structural steel frame combines a number of features carrying out entirely different functions, viz.:—

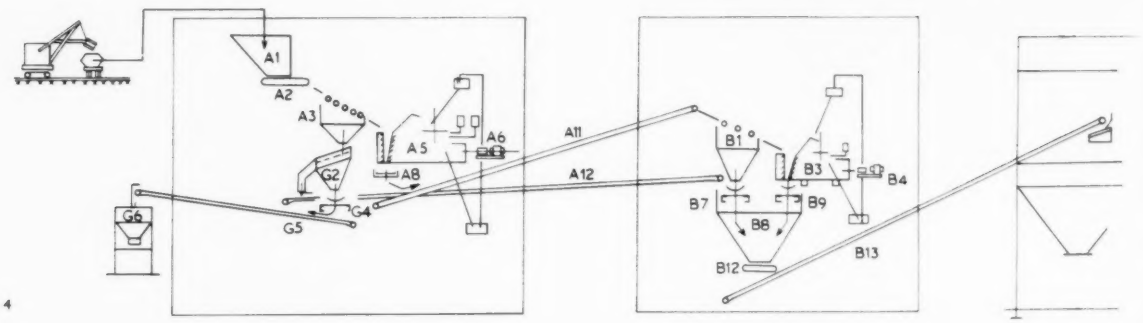
1. Screening and separating the stone into different sizes.
2. Storage in bins each containing different sizes of stone.
3. Side chutes and valves to enable road vehicles to be filled from these bins.

Fig. 3. A view of the quarry face, the excavator and side-tipping vehicles

Fig. 4. Flow diagram for the primary and secondary crushing plants. A1, *dumping hopper;* A2, *pan feeder;* A3, *five-roll grizzley;* A5, 72 × 48-*in Hadfield jaw breaker;* A6, *water pump and tanks;* A8, *jigging feeder;* G2, *dirt vibrating screen;* G4, 24-*in wide dirt conveyor;* G5, 24-*in wide dirt conveyor;* G6, *dirt storage hopper;* A11, 48-*in wide crushed stone conveyor;* A12, 24-*in wide small stone conveyor;* B1, *three-roll grizzley;* B3, 42 × 39-*in Hadfield jaw breaker;* B4, *water pump and tanks;* B7, 42-*in wide conveyor;* B8, *surge hopper;* B9, 42-*in wide conveyor;* B12, 40-*in wide apron feeder;* B13, 48-*in wide conveyor to screening plant*

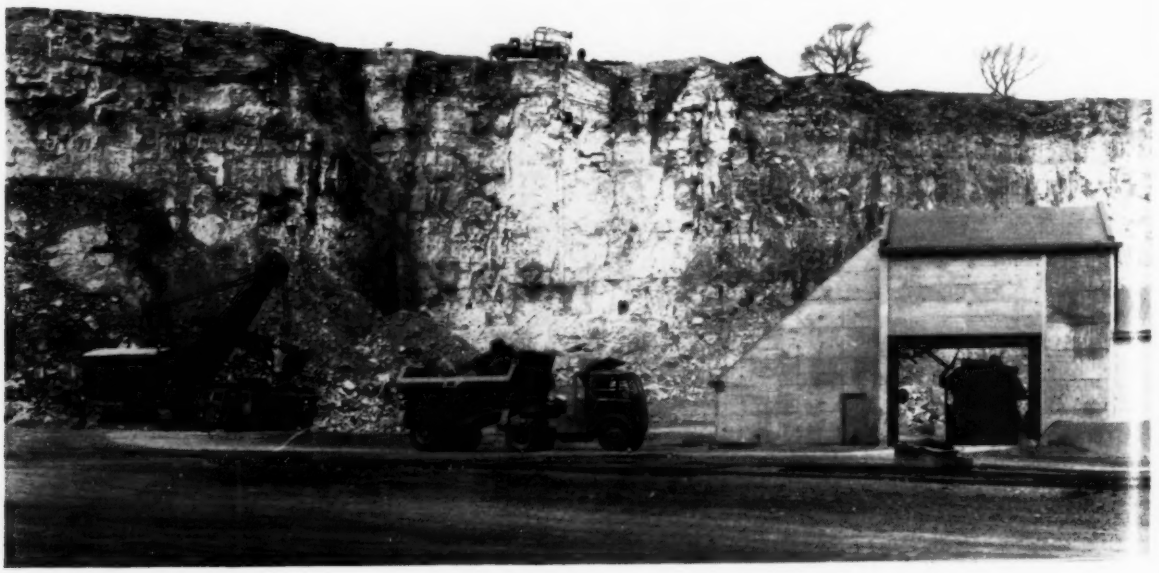
Fig. 5 The primary crusher house five-roll grizzley and jaw breaker

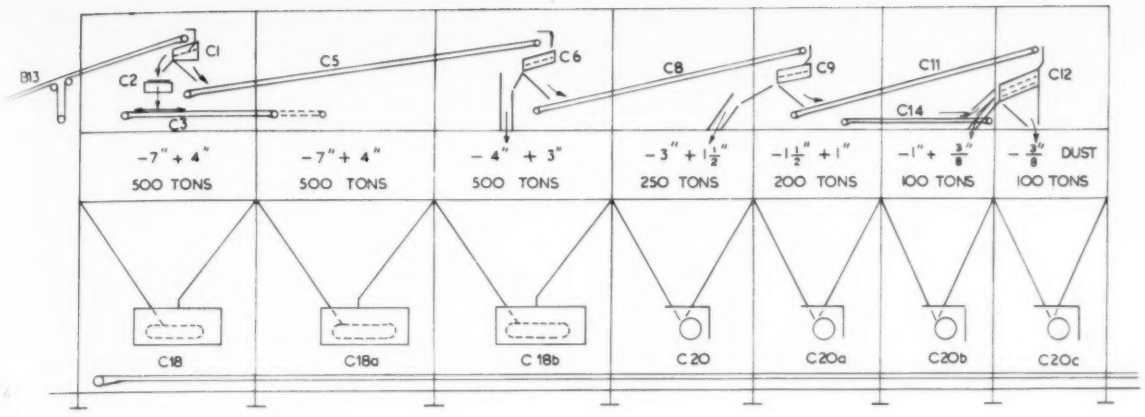
5



4

3





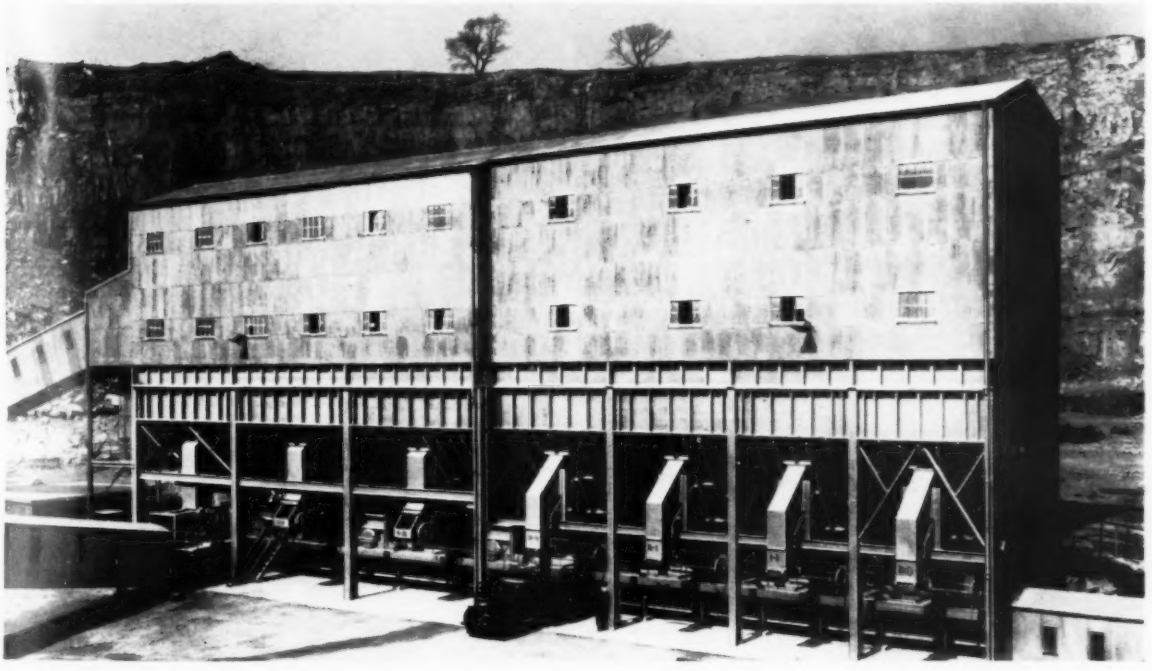


Fig. 6. Flow diagram of screening plant. Key: C1, 42-*in* × 5-*ft vibrating Norderg bar grizzley;* C2, 48-*in wide reversible flat belt conveyor;* C3, *two* 36-*in wide shuttle belt conveyors;* C5, 30-*in wide belt conveyor;* C6, 10 × 4-*ft single-deck vibrating screen;* C8, 24-*in wide belt conveyor;* C9, 10 × 4-*ft single-deck vibrating screen;* C11, 24-*in wide belt conveyor;* C12, 8 × 3-*ft double-deck vibrating screen;* C14, 24-*in wide belt conveyor;* C18, 40-*in wide apron feeder;* C18a, 40-*in wide apron feeder;* C18b, 40-*in wide apron feeder;* C20, *roll feeder;* C20a, *roll feeder;* C20b, *roll feeder;* C20c, *roll feeder*

Fig. 7. View of exterior of screen house showing road loading chutes, bottom conveyor to railway and conveyor to kilns, left

4. Bottom feeders for delivering stone on to a bottom conveyor for transporting it to the railway loading house.
5. A side offtake on Bin No. 1 containing the largest size enables stone to be transferred by an independent conveyor system to the top of the lime kilns.

The screening is carried out over the bins with an arrangement starting with an inclined conveyor so that material falling over the end drops on to a screen; material not passing the screen is shaken (through various chutes and auxiliary conveyors) into the bin below; material passing through the screen falls on to another inclined conveyor supplying the next size smaller screen and corresponding bin over which the process is repeated. In this way the following bins receive the sizes indicated:—

Bins 1 and 2 (capacity 500 tons each):
size −7 +4 in
Bin 3 (capacity 500 tons): size −4 +3 in
Bin 4 (capacity 250 tons): size −3 +1½ in
Bin 5 (capacity 200 tons): size −1½ +1 in
Bin 6 (capacity 100 tons): size −1 +⅜ in
Bin 7 (capacity 100 tons): size −⅜ +0 in

The layout of the conveyors and screens necessarily means that the bins holding the larger sizes are filled first and the fines in each case pass to the next bin.

Consequently, the detail of the screen house operation commences with the conveyor leading from the base of the crusher house surge hopper; this elevates the stone to the top of the screen house for the first screening stage when

Fig. 8. The main belt conveyor from screens to railway

the stone drops on to a vibrating bar grizzley screen which retains on the mesh the minus 7 in to plus 4 in size until it is shaken on to a 48-in reversible conveyor. This feeds either of two 36-in wide shuttle conveyors running at right angles over the first two parallel bins each of 500 tons capacity. The shuttle conveyors may be traversed in either direction for a limited distance lengthways over the two bins.

The stone passing through the vibrating grizzley is carried on a 30-in conveyor to a single-deck vibrating screen which takes out all minus 4 in to plus 3 in material for depositing into the 500-ton capacity bin (No. 3) below. A 24-in wide conveyor then takes the fines to the next screen to remove size minus 3 in to plus 1½ in. The final screening takes place in an 8 × 3-ft double-deck vibrating screen.

The screening plant grades the limestone into six sizes, any of which can be discharged by apron-type feeders for the larger sizes or roll feeders for the smaller, on to the main belt conveyor running under the hoppers for delivery to the railway loading station, a quarter of a mile away. Alternatively, any size of stone can be discharged by quick-acting side valves directly into lorries for despatch by road transport. From the first bin limestone minus 7, plus 4 in can be withdrawn for delivery direct to the company's lime kilns by conveyor belt. This is inclined and of 471 ft centres.

The Railway Loading House

The railway loading house (like the screen house) is of steel sheeting on a structural steel frame and incorporates a number of different pieces of equipment which may be summarized as follows:—

(1) The conveyor system for delivering stone to different bins.

(2) The temporary storage hoppers of the following capacities for keeping separate the various sizes of stone:—
Bin 1 (for minus 7 in, plus 4 in) of 540 tons capacity.
Bin 2 (for minus 4 in, plus 3 in) of 270 tons capacity.
Bin 3 (spare reserve) of 270 tons capacity.
Bin 4 (for minus 3 in, plus 1½ in) of 220 tons capacity.
Bin 5 (for minus 1½ in, plus 1 in) of 220 tons capacity.

(3) The pneumatically operated discharge valves at the base of the hoppers.

(4) The double rail track under the hoppers.

The main conveyor from the screening plant to the loading station consists of a single endless belt 2,770 ft long, 42 in wide and running at 1,368-ft centres. It delivers all sizes of material at the rate of 300 tons/hr. Automatic deadweight tensioning equipment is provided in a tower positioned mid-way along the conveyor, which also houses the 80-h.p. driving motor, driving head and tandem driving pulleys.

The size and flow of stone from the screening plant is remotely controlled from a panel situated in the loading station. The electronic equipment enables any size of stone in the screenhouse hoppers to be directed on to the conveyor and in order that the stone may be allocated to the right bin upon its arrival in the railway loading house, a safety device is incorporated to prevent the mechanism from working until the receiving conveyor there is positioned

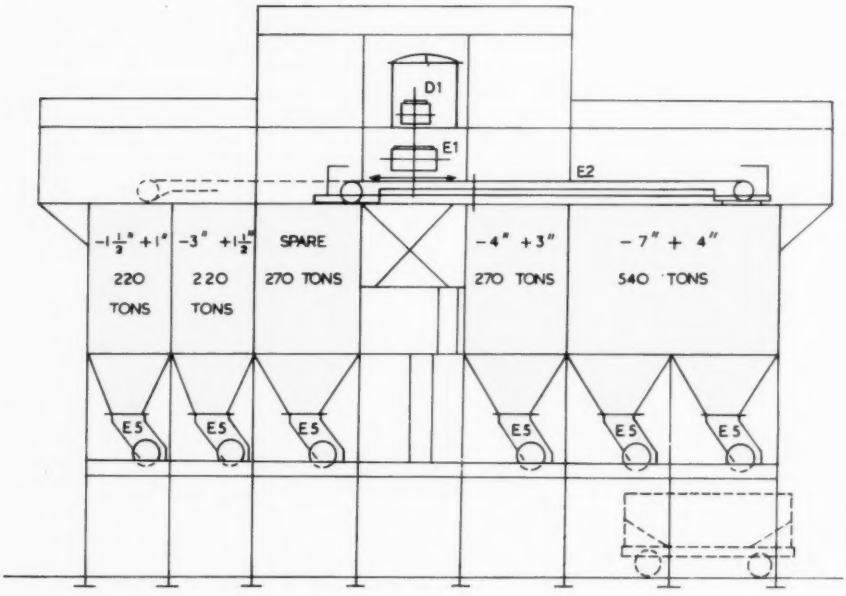


Fig. 9. Flow diagram of rail/road loading station. Key: D1, *main belt conveyor;* E1, *reversible flat belt conveyor;* E2, *shuttle belt conveyors;* E5, *pneumatically operated discharging valves*

12

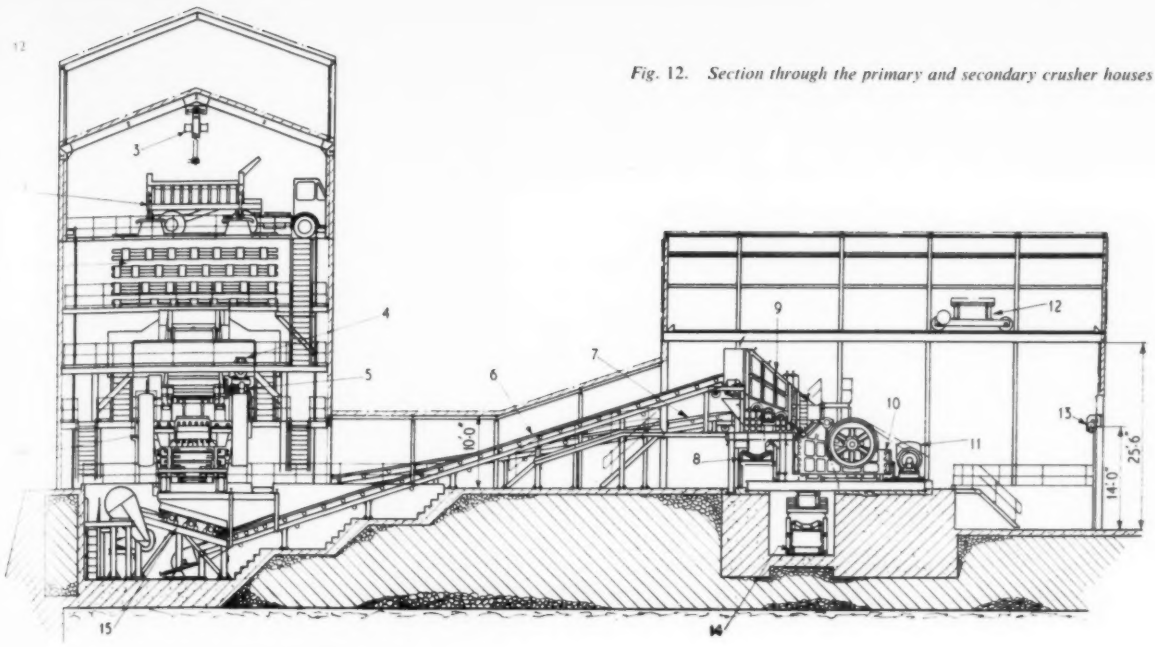
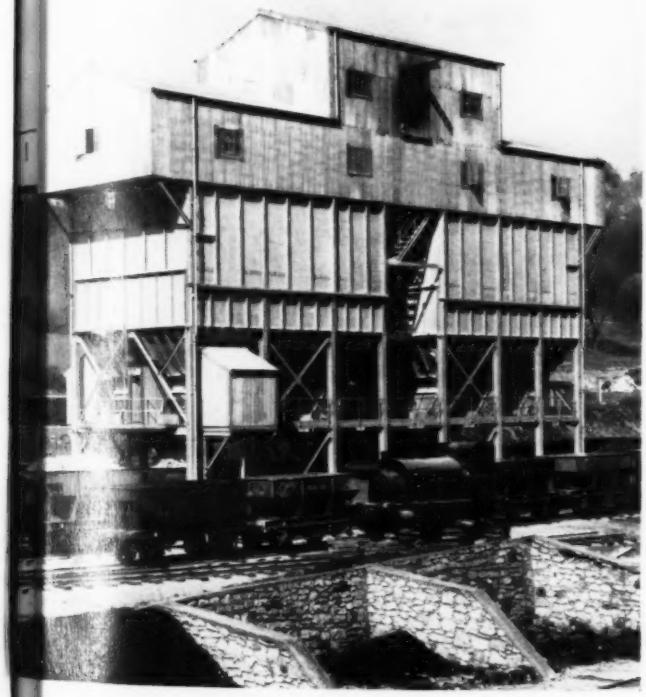


Fig. 12. Section through the primary and secondary crusher houses

KEY TO FIG. 12

1. Quarry dumper on semi-trailer with four-wheeled tractor
2. M.S. dumping hopper
3. 5-ton one-motor electric hoist
4. Drive for 6-ft wide × 14-ft centres pan feeder
5. Drive for live roller grizzley
6. 48-in wide troughed belt conveyor
7. 24-in wide troughed belt conveyor for clean stone
8. 42-in wide horizontal troughed belt conveyor
9. Live roller grizzley
10. 42 in × 30-in jaw breaker
11. 120-h.p. motor
12. 12-ton single-motor overhead travelling hand crane
13. Roll shutter operating gear
14. 42-in wide inclined troughed belt conveyor
15. 36-in wide jigger feed
16. 72 in × 48-in jaw breaker

10



11

Fig. 11. Shuttle belt conveyors at the top of the loading station

Fig. 10. Exterior view of the rail/road loading

over the correct bin. A centrally placed conveyor receives the stone from the main conveyor and feeds either of two shuttle conveyors in a similar manner to that used at the screening plant.

Bins at the loading station are arranged in two rows of six over two railway tracks. Pneumatically operated discharge valves are provided to each bin permitting a 20-ton wagon to be loaded in 1 min. Weighbridges are provided for each track.

In the current working of the quarry there is a demand

for limestone of certain sizes to be collected at any time of the day or night. As a result it has been found convenient to use the railway loading station for filling road vehicles as well as for its primary purpose of loading rail wagons —and this has proved quite satisfactory.

Conclusion

One of the most interesting features of this Bowne & Shaw quarry at Wirksworth is the way in which the mechanical handling equipment is used to keep the parallel operations of the entire plant in balance. In this way the customer demand is met by the continuous availability simultaneously at the two main loading points of all the stone sizes marketed. This is carried to the point where the operators at the loading stations in effect call up the sizes needed to replenish their bins as stocks fall. Consequently, in this case the mechanical handling and control systems have a very direct effect on assisting the customer and so attracting an increased trade. In addition the installation is both large and orderly as well as markedly successful.

Acknowledgments are given to Stewarts and Lloyds Minerals, Ltd., who kindly gave permission to secure and publish this data.

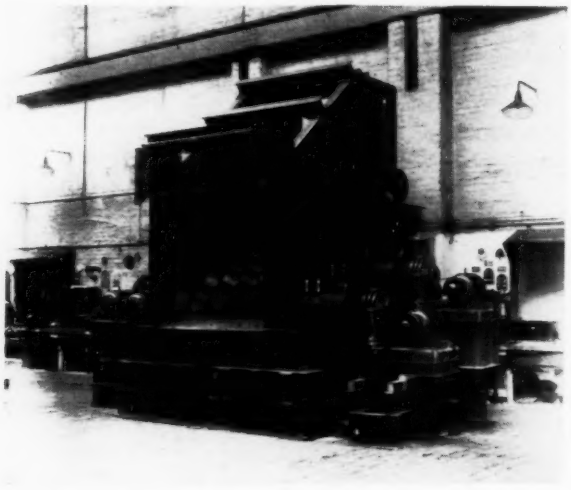


Fig. 13. Works view of the five-roll grizzley for removing all 7-in material from the crushed product

Fig. 14. The apron feeder for feeding material to the main belt conveyor leading to the screening plant

Fig. 15. Interior view of the hopper showing rigid construction. Lining plates are bolted to ¾-in thick steel plates which are mounted on heavy joists embedded in concrete. This design enables hopper to receive lumps of limestone up to 66 × 42 × 42 in.

Contractors, Surveyors, Engineers, Sub-contractors

Stewart and Lloyds Minerals, Ltd., were responsible for all surveying and planning of the complete plant and for the design of the electrical installation.
Davie, Crawford & Partners : consultants for civil engineering work.
Shanks & McEwan: contractors for civil engineering work.
H. B. Pearce, Ltd.: contractors for civil engineering work.
Electrical Equipment Co., Ltd.: contractors for the electrical installation.
Ruston-Bucyrus, Ltd., supplied the 120-R.B. face shovel.
Eagle Engineering Co., supplied the Eagle dumpers.
Consolidated Pneumatic, Ltd., Reich Drill Division, London, supplied the Reich rotary blast hole drill.

Main Contractors

Ernest Newell & Co., Ltd.: consultants, designers and engineers. Responsible for the complete crushing, handling, screening and loading equipment.

Sub-contractors

Hadfields, Ltd.: 72 × 48-in primary crusher-pan feeder; five-roll grizzley and 42 × 30-in secondary crusher.
T. Partridge & Co., Ltd.: steelwork for primary and secondary crusher house buildings, screen house and main conveyor gantry.
Dawnays, Ltd.: steelwork and bins for loading station.
Allott Bros. & Leigh, Ltd.: main dumping hopper.
New Conveyor Co., Ltd.: conveyor idlers.
British Tyre & Rubber Co., Ltd.: conveyor belts.
Northern Mfg. Co., Ltd.: gear units used on this installation.
George Ellison, Ltd.: switchgear.
English Electric Co., Ltd.: motors and switchgear.
Igranic Electric Co., Ltd.: electrical control equipment.
S. H. Heywood & Co., Ltd.: lorry-tipping winch and equipment.
Heenan & Froude, Ltd.: Dynamatic coupling.
Mining Engineering Co., Ltd.: conveyor system to lime kilns.

HANDLING WITH INDUSTRIAL TRUCKS

PART 8 — THEIR USE ON THE PUBLIC HIGHWAY, FOR SWEEPING AND CLEANING, AND FOR VEHICLE LOADING

by L. J. Hoefkens, A.I.Prod.E.

In certain circumstances it is desirable for trucks to travel along or across the public highway. In such cases the following regulations apply:

If a vehicle is to travel on the highway there are three aspects to be taken into account—

(*a*) its construction
(*b*) a road fund licence
(*c*) a goods vehicle licence (if it is to carry goods).

A fork lift truck for instance is not designed to use the highway as a matter of course and thus is deficient in certain features which would otherwise be required.

The Construction and Use regulations take account of this and create a special definition, namely: Works Truck. A 'Works Truck' means a motor vehicle (other than a Straddle Carrier) designed for use in private premises and used on a road only in passing from one part of any such premises to another or to other private premises in the immediate neighbourhood. Therefore, so long as a fork lift truck keeps within this definition, it is allowed the following exemptions.

Brakes: Only one braking system with one means of operation is required.

Tyres: Solid tyres may be used.

Springs: It need not have suitable and sufficient springs between each wheel and the chassis frame.

Wheels: It need not comply with the minimum diameter of 670 mm laid down for wheels not having pneumatic tyres.

Neither a rear view mirror nor a horn is required.

As will be seen the exemptions from the regulations are dependent upon the use of the 'Works Truck' on a public highway only for the purpose of passing from one part of the premises to another. This purpose is equally important in gaining exemption from taxation and the need for a goods licence.

In regard to taxation, the position is that, subject to the approval of the Minister of Transport, no tax is payable on a vehicle which uses public roads only in passing from land in the owner's occupation to other land in his occupation for distances not exceeding in the aggregate six miles in any week. Cases of this kind are dealt with by special application to the appropriate vehicle taxation licensing office. The vehicles must carry the usual registration number plates and regular application must be made for renewal of the licence although no payment is required.

If the vehicle carries goods, then in order to be exempt from this licence, the distance travelled on a road passing from one part of a works to another is also six miles per week/vehicle.

A Case History: Conveyor & Fork Lift Truck

At meetings, lectures and conferences dealing with the subject of materials handling one often hears these or similar questions posed to the lecturer or the panel of experts: 'Do you consider that the fork lift truck has taken the place of the conveyor?' or 'Which is the most economical method of transportation, a conveyor or a fork lift truck?'

Fig. 1. Manually propelled floor sweeper truck by Cimex-Fraser Tuson, Ltd.

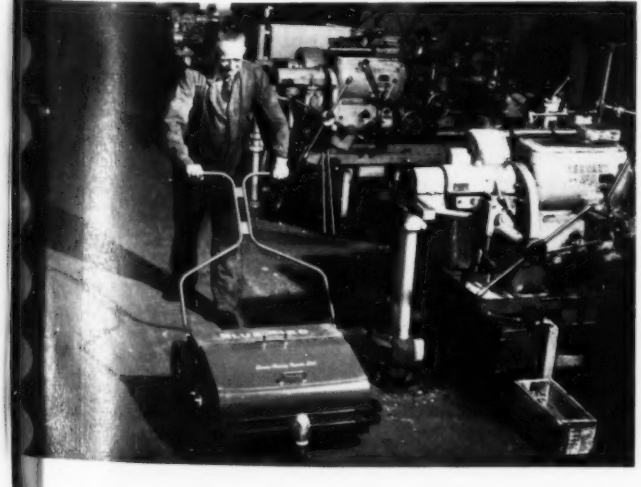


Fig. 2. An industrial power-driven sweeper truck by Matling, Ltd. Note side brushes for sweeping right up to the kerb

Fig. 3. Cimex-Fraser-Tuson, driver-controlled industrial sweeper truck for large areas. Note separate vacuum attachment for cleaning walls, shelves, overhead pipes, etc.

This type of question arises through lack of appreciation of the purpose and function of these two distinct and important means of handling materials.

As with so many subjects connected with industry and certainly those which fall under the heading of materials handling, it is quite incorrect to generalize.

Sometimes broad statements are made such as 'Employ fork lift trucks where varying loads are required intermittently' or again 'Use conveyors where the work flow is constant between two fixed positions'. While these principles will hold good in many cases one can also think of instances where they cannot be applied and it is recommended that each and every case should be studied thoroughly and an economic cost justification study built up which will also take into consideration any other salient factors applicable to that individual case, before arriving at a decision regarding the best method.

The expression 'best method' can apply only to that condition at that time as it can quite easily be rendered obsolete by subsequent changes to output rate, product design or factory layout.

Let us examine a specific case history which treats both with a conveyor system and the fork lift truck and pallet method of materials handling. It is coincidental that in this particular case history the conveyor was replaced by fork lift trucks and pallets. When the circumstances are studied it will demonstrate the need to look into each case as it arises and to re-study what has already been done and that existing methods should not necessarily be perpetuated merely because they are in being. The case history should certainly not be interpreted as a condemnation of one method by comparison with another.

Each system, conveyor or fork lift truck, with pallets, has its own rightful sphere of operation which can only be determined by the study and careful consideration of all pertinent circumstances. There are instances in industry where the two methods of moving materials are complementary, being integrated or synchronized with each other to form one complete handling system.

The factory concerned had installed a power-pull conveyor fitted with work carrying trays and which travelled round a circuit of some 500 yds. Its purpose was to transport materials such as small castings, pressings and forgings from a rough store to various positions in a machine shop, to transport pressings to and from an enamelling and stoving shop and to convey finished products from the end of several assembly belts to a dispatch warehouse. It travelled at a speed of 25 ft/min and a work tray passed a given point every 13 sec. The conveyor route took it through fairly congested areas and stores with narrow traffic aisles and in several places it went up to a high level under the roof trusses.

This method of handling the materials already described gave satisfaction for a number of years. The materials flowed smoothly from point to point at speed and the working areas which it serviced were kept clear of materials. Maintenance was found to be slight and rarely did the equipment break down. In general, it was considered to be eminently suitable for the need and certainly a great improvement on the previous methods involving hand trucks and small one-ton petrol trucks with platforms.

Some two years after the conveyor had been installed fork lift trucks and pallets were introduced into this factory to operate in such sections as the goods receiving and despatch departments and certain stores. As time went by production increased and consequently the volume of materials to be handled per working shift. Gradually, as a result of this, it was no longer possible to feed all the materials by conveyor which had been planned to be transported by that medium. It was found that the personnel were however using their initiative and were making use of the fork lift trucks to supplement this transport deficiency. In so doing, such persons as progress men and production supervisors commenced to realize that particularly in cases of urgency a flexible and mobile means of mechanical transportation was speedier than to send the same materials by the conveyor.

Consequently the company ended up with two very different and alternative methods of transportation; one supplemented the other and both were accepted by all concerned. This condition existed for some considerable time until important increases to the manufacturing programmes became imminent, making plans for expansion necessary.

By now there was a general awareness that the conveyor was inadequate for the needs of the factory in spite of its having been speeded up and that therefore a complete and thorough review of the situation would be necessary to determine the best way to handle the increased load.

When the expansion lay-out plans had been drawn up they revealed that considerable extension of the conveyor system would be required to embrace the new areas. The cost of this extension was obtained from the suppliers of the conveyor who quoted a figure of £9,310 including all materials and installation labour.

Fig. 4. A covered vehicle being unloaded. An industrial truck removing a palletized load using a bridge plate by Slingsby, Ltd.

The cost of operating the new extended conveyor was calculated to be 16s. 3d. per hr. This figure includes depreciation, maintenance labour, maintenance materials, electric power and overheads on labour. It was also necessary to calculate the cost of moving the envisaged new programme by means of the conveyor. Included in these costs is also some fork lift truck work because at this stage, as explained earlier, this means of transport was being made use of in conjunction with the conveyor system. In other words, based on the existing methods and costs, a cost was worked out on the assumption that they would be perpetuated but augmented to cope with the increased amount of materials to be transported in the future. These costs were calculated as follows on a monthly basis as this was the company's method of expressing its programmes.

	£	s.	d.
Conveyor running costs	195	0	0
Labour costs to load and unload the conveyor	104	2	6
Fork truck running costs (total cost including labour)	27	0	6
	£326	3	0 per month

The next step was to visualize that all the above work would be done exclusively by means of fork lift trucks and that no use would be made of a conveyor and then to calculate the operating cost of performing the identical load. This figure came to £112 10s. 5d. per month and includes labour and full running costs of fork lift trucks. The latter cost includes fuel, spares, maintenance labour, overheads on labour and depreciation.

Furthermore as a result of the new layout it was found that one additional fork lift truck would be required mainly to travel over an outside route to a warehouse and that in addition two towing trailers would be needed and a small structural alteration to one doorway. The capital expenditure comparison statement between the two systems was therefore as follows:—

With extended conveyor system			£9,310	0 0
With fork lift trucks				
Fork lift trucks	£1,200	0 0		
Trailers	£260	0 0		
Structural alterations	£58	0 0		
			£1,518	0 0

Summarizing the foregoing it was found:

1. (*a*) that to extend the existing conveyor system to conform to the new layout would require a capital expenditure of £9,310.
   (*b*) that to perform precisely the same task by fork lift truck would require a capital expenditure of £1,518.
2. (*a*) that the annual running cost of the extended conveyor transport system would be £3,913 16s. 0d.
   (*b*) that the annual running cost of performing the same work by fork lift trucks would be £1,350 5s. 0d.
3. that the savings between the two methods of operating would be £2,563 11s. 0d. per annum and that therefore the capital expenditure to bring this about would be recovered in approximately 7½ months.

The conclusions to be drawn from the above are obvious and needless to say the conveyor system was not extended. It should be pointed out however and emphasized to the reader that the costs and figures are a number of years out of date and would not be valid in another context. It must also be stressed that the findings and conclusions arising from this case history are to a great extent dependent on special circumstances and conditions and no generalization should be inferred from this study.

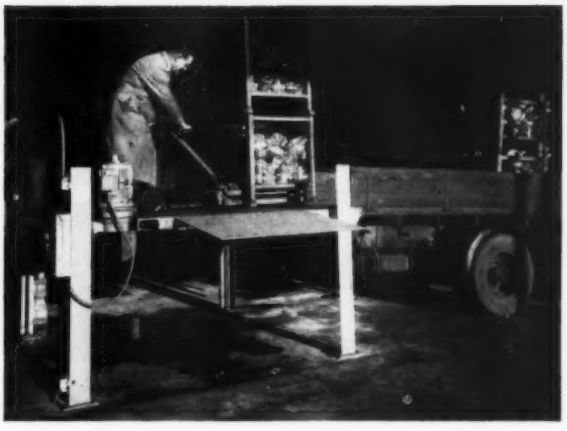


Fig. 5. Laycock elevating platform in the raised position. Pallets being placed on a road vehicle by means of a hand-propelled pallet truck

Fig. 6. Laycock elevating platform in the lowered position. Note hinged ramp

It should however prove to the reader that in these matters 'circumstances alter cases' and that accepted systems however satisfactory should frequently be reviewed and not accepted and perpetuated merely because they exist.

There was one other important factor which arose to aid management in its decision. The factory expansion was required and scheduled to take place in six or seven months' time. Whereas an extended conveyor could not have been completed before about fifteen months, there would therefore have been a gap of some seven or eight months during which time some alternative means of transport would have had to be found. On the other hand the fork lift truck and trailers could be delivered within the requisite time.

Management's attention was also drawn to the fact that considerable sums of money had been expended on minor route modifications to the conveyor during its life to conform to shop layout changes but that with a more flexible trans-

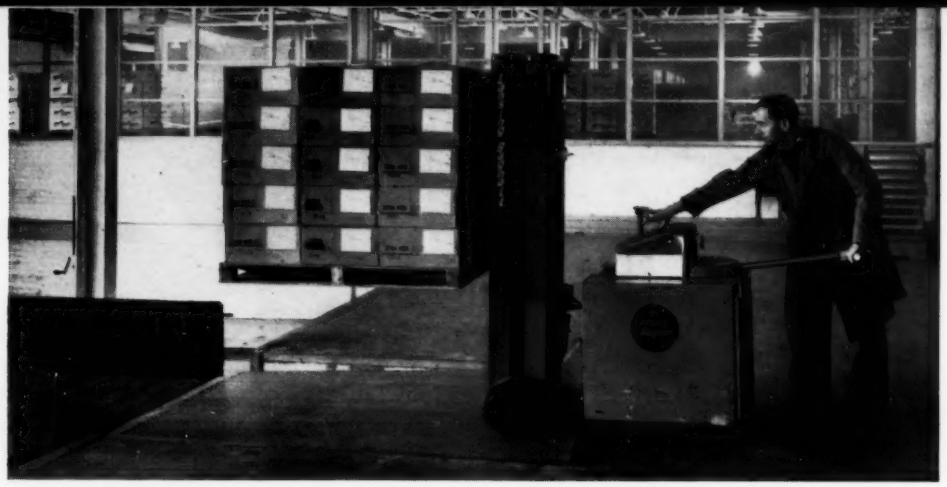


Fig. 7. A pedestrian-controlled electric fork lift truck transporting a pallet load over a dock leveller (by Wayne Tank & Pump Co., Ltd.) driven on to a vehicle

Fig. 8. A pedestrian-controlled electric fork lift truck transporting a pallet load over a dock leveller up on to a vehicle. Note hydraulic lifting ram under the dock leveller

port system such as the fork lift truck and pallets this type of expenditure and inconvenience would not arise.

Sweeping and Cleaning Trucks

Regulations in the Factories Act insist on a high degree of cleanliness and hygiene in workshops and warehouses not only to provide better and healthier work conditions but also for safety reasons. Floors must be maintained in a clean and non-slippery condition so as to prevent accidents by persons falling and injuring themselves.

As factories, warehouses and canteens become larger the problem of keeping extensive floor areas clean has increased to such an extent that it is no longer practicable or economical to carry out these tasks manually. The industrial truck industry realizing the need for mechanical aids to solve these problems have developed a whole range of trucks, from a simple manually propelled brush cleaner to the large power-driven driver-operated yard sweeper similar to those used by municipal authorities.

A manually propelled floor sweeper truck for brushing and sweeping gangways is shown in Fig. 1. A similar model is available powered by a 1-h.p., 2-stroke petrol motor which propels the truck and at the same time operates an anti-dust vacuum unit. The petrol consumption is only $\frac{3}{4}$ pint hr. The width of sweep is 12 in and the brush is quickly removable likewise the power unit should it be required to operate the truck manually in certain areas. The truck is easily manœuvrable and is controlled by the operator by a single lever.

A larger power-driven model is shown in Fig. 2. It is pedestrian controlled but an attachment can be obtained which will enable the operator to ride behind the truck. There are three sizes, 24 in, 36 in, or 48 in wide, depending on the width of the aisles or size of area to be swept. Power is by means of a 4-stroke petrol engine. By means of additional side brushes it can sweep right up to walls, pillars, machines or a roadside kerb. The operator has full view of the area to be swept and the 3-wheel suspension makes steering effortless. The brush pressure can be adjusted to meet all conditions simply by raising or lowering the front wheel. Correct weight distribution makes it easy to tilt the truck

over obstructions. A heavy front bumper affords ample protection to the sweeping chamber. There are twelve brushes in all which can be made of fibre and wire, all fibre or wirecrimp and can be placed in combinations to handle various sweeping conditions. The dust collecting system is designed to draw dust-laden air from the top of the hopper discharging this air to the dust bay through a cyclone-type spinner which separates the heavy particles of debris which are returned to the hopper. The suction produced in the brush reel chamber draws the dust from cracks and uneven surfaces more thoroughly and completely than is possible with a broom. Since no water is used, no streaks are left. Heavy rubberized-fabric strips seal the edges of the sweeping chamber and prevent dust spreading.

A further example is shown in Fig. 3. It has been specially designed for use inside large factories, warehouses, hangars, etc. It is a driver-controlled vacuum sweeper and will pick up all litter in its path, while airborne dust is drawn up and deposited in a large tray. A small horizontal brush is fitted to the front near side so that the vehicle cleans right up to a wall. A separate suction attachment and tools are provided for cleaning walls, shelves, overhead pipes, etc. The operating cost is low and the simple two-pedal (start stop) operation makes it unnecessary to have a trained driver.

Vehicle Loading by Industrial Trucks

In the past where the manual handling of all types of materials and commodities was the order of the day, or even where hoists or cranes were employed, it did not appear very important to give much consideration to the relative heights of transport vehicles or railway trucks and the loading decks or platforms in conjunction with which they operated presumably because serious difficulties did not arise.

However, with the introduction of palletized traffic and the elimination of much of the manual handling of individual items between producer and use, by virtue of the unit load problems soon became apparent.

These problems were frequently found to be obstacles to the new methods as palletized loads could not be trucked on and off vehicles or in and out of railway wagons but had to be manhandled. To obviate this handling it now became a necessity for a truck to enter a lorry or wagon to place in it or to remove from it a palletized load.

The problem arises through the differences in levels between loading platforms and despatch decks and the floors of vehicles or wagons. Not only does a difference exist which can vary from destination to destination but this difference changes as a vehicle becomes more and more loaded or unloaded, as the case might be, due to the flexing, under load, of the road springs and the pneumatic tyres, thereby raising or lowering the floor of the vehicle in relation to the loading or unloading platform.

Equipment manufacturers being made aware of these problems have met the needs of industrial truck users by developing and putting on the market devices such as bridge plates and equipment such as lifting platforms and dock levellers. Typical examples will be briefly described.

Fig. 4 shows a lightweight bridge plate or dock board used for bridging the gap between a loading platform and a vehicle. By this means laden trucks can be run smoothly and safely into a vehicle without jolting and discomfort to the operator. This particular example is fabricated from aluminium alloy and whilst it will support $\frac{1}{2}$ ton, it weighs only 75 lb. It can be obtained in longer lengths if required and provided with additional devices such as blocked ends, toe plates or hooks for securing it to the vehicle. Heavier types to carry a mechanical truck with a greater load can be made with carrying loops so that a fork lift can bring it to the position where it is required, place it ready for use and remove it when the loading or unloading operation has been completed.

A further example of an aid to vehicle loading by industrial trucks is the elevating platform, Fig. 5. By means of this piece of equipment the speedy loading and unloading of vehicles by industrial trucks is made possible in circumstances where no raised loading decks are available.

A substantial platform travels up and down four long corner screws, housed and protected by corner posts. Loads up to three tons can be carried up to a height of 4 ft $8\frac{1}{2}$ in above floor level, although higher lifts are obtainable. The platform is safely locked in any halting position automatically. Raising and lowering of the platform is done entirely by an electric motor of only 3 h.p., to that operating costs are very low. This equipment is floor mounting and requires no excavation work. It is therefore possible not only to use this equipment for vehicle loading but also for bridging the gap between different floor levels in factories and warehouses thus making the employment of industrial trucks possible under conditions where otherwise their use would be out of the question.

In cases of layout change or building alterations this equipment can readily be removed without incurring much expense or damage to the original site.

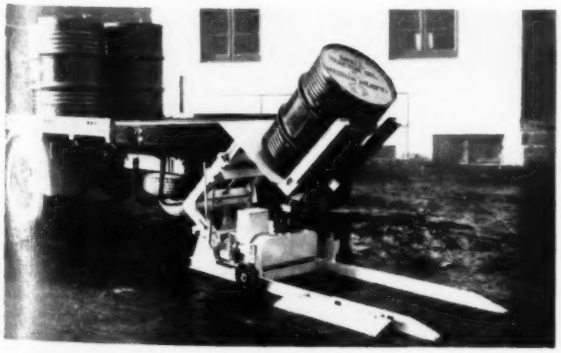
When at ground level, as in Fig. 6, it will be seen that ramps are available for the trucks to get on to the main platform.

A final example is a dock leveller for use when there are already loading decks in existence, Fig. 7. This equipment consists of an hydraulically operated tilting ramp hinged to the loading deck which is adjustable to all lorry tailboard heights. It is simple to install into existing docks or platforms or can be made part of a new construction. The raising and lowering of the ramp is controlled by a single switch. Movement of the switch to the "Up" position starts the power unit, which in turn extends the ram, thus raising the ramp. Releasing the switch will stop the ramp.

After the vehicle to be loaded or unloaded has been reversed into position, movement of the switch to the 'Down' position lowers the ramp on to the tailboard of the vehicle. If the switch is left in the 'Down' position it will allow the platform to float automatically with the tailboard as the vehicle is loaded or unloaded, Fig. 8. An automatic cushioning device prevents the rapid descent of the ramp should the lorry drive away unexpectedly.

When not in use for loading purposes the ramp is left in a horizontal position, thus becoming part of the dock and is capable of sustaining a roll-over load up to its rated capacity, which is 20,000 lb. The platform is 8 ft by 6 ft and has a total adjustment of 22 in at the leading edge. It can be made for deck heights varying between 36 and 50 in with a maximum ramp gradient of 1 in 10.

Fig. 9. Hydrum model LP mobile lorry loader made by R. H. Corbett & Co., Ltd.



CLASSIFIED GUIDE TO MANUFACTURERS' PRODUCTS

To meet the many enquiries and requests that have been received since the conclusion of the 7th Mechanical Handling Exhibition, organized by this journal, we are reprinting in the following pages a Classified Guide to the products manufactured by the Exhibitors. It is emphasized that this is **not** *a complete list of manufacturers but covers only those at the Exhibition and which were included in the official catalogue. A list of names in alphabetical order, together with addresses, telephone numbers and telegraphic addresses will appear in the August issue.*

1 Accumulators/Batteries
Accumulateurs/Batteries
Akkumulatoren/Batterien
Acumuladores/Baterias
Associated Electrical Industries, Ltd.
C.A.V., Ltd.
Chloride Batteries, Ltd.
The D.P. Battery Co., Ltd.
Nife Batteries
Oldham & Son, Ltd.
S. Smith & Sons (England), Ltd.

2 Adjustable Dock Ramp
Rampe Réglable pour docks
Verstellbare Hafen-Laderampe
Rampa graduable paramuelles
G. Hunter (London), Ltd.
Laycock Engineering, Ltd.
Sheepbridge Equipment, Ltd.

3 Aerial Ropeways
Transporteurs aériens à câble
Drahtseilbahnen
Transportadores por cables aéreos
British Ropeway Engineering Co., Ltd.
Mitchell Engineering, Ltd.
Ropeways, Ltd.

4 Ash Handling Plant
Matériel pour manutention des cendres
Aschenförderanlagen
Instalacionés para el manipuleo de cenizas
Babcock & Wilcox, Ltd.
Bennis Combustion, Ltd.
British Ropeway Engineering Co., Ltd.
Ewart Chainbelt Co., Ltd.
International Combustion Products Ltd.
Mitchell Engineering, Ltd.
Paterson Hughes Engineering Co., Ltd.
Redler Conveyors, Ltd.
Rendale Conveyors, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Richard Sutcliffe, Ltd.
Thos. W. Ward, Ltd.
West's Group of Industries
Winget, Ltd.

5 Bag or Sack Fillers
Ensacheurs
Sackfüller
Ensacadoras
W. S. Barron & Son, Ltd.
Crane & Taylor (Engineering), Ltd.
C. H. Johnson (Machinery), Ltd
Lodematic, Ltd.
Mucon Engineering Co., Ltd.
Richardson Scale Co., Ltd.
Thomas Robinson & Son, Ltd.
Webb Conveyors & Automation, Ltd.
Winget, Ltd.
W. C. Youngman, Ltd.

6 Banking and Insurance Facilities and Finance
Facilitiés de banque et d'assurance
Bank- und Versicherungsagenturen
Servicios Bancarios y de Seguros
Industrial and Commercial Finance Corporation, Ltd.
Lloyds Bank, Ltd.
Midland Bank, Ltd.
United Dominions Trust (Commercial), Ltd.

7 Battery Charging Equipment
Equipement pour charge des batteries
Batterieladegeräte
Equipos para carga de baterias
Associated Electrical Industries, Ltd.
W. E. Burnand & Son, Ltd.
C.A.V., Ltd.
Lansing Bagnall, Ltd.
Legg (Industries), Ltd.
Leverton & Co., Ltd.
Fred Myers, Ltd.
Oldham & Son, Ltd.
Salisbury Precision Engineering, Ltd.
Westinghouse Brake & Signal Co., Ltd.

8 Bearings
Roulements
Lager
Rodamientos
Autoset (Production), Ltd.
BTR Industries, Ltd.
J. Collis & Sons, Ltd.
Cordey-Thomson
Ewart Chainbelt Co., Ltd.
F'Ag Bearing Co., Ltd.
Gimson & Co. (Leicester), Ltd.
Pollard Bearings, Ltd.
Priestman Bros., Ltd.
Roballo Engineering Co., Ltd.

9 Belting (all types)
Courroies (en tous genres)
Förderriemen (aller Art)
Correas (todos tipos)
Abisch Conveyor & Furnace Co., Ltd.
Barrow Hepburn & Gale, Ltd.
British Wedge Wire Co., Ltd.
BTR Industries, Ltd.
Crofts (Engineers), Ltd.
Dunlop Rubber Co., Ltd.
Ewart Chainbelt Co., Ltd.
Gandy, Ltd.
Gardiner's Conveyors, Ltd.
The Goodyear Tyre & Rubber Co. (Great Britain), Ltd.
William Kenyon & Sons, Ltd.
Numec, Ltd.
Silvertown Rubber Co., Ltd.
Stephens Belting Co., Ltd.
T. & T. Works, Ltd.
Turner Bros. Asbestos Co., Ltd.

9a Belt Repairing Machines
Barrow Hepburn and Gale, Ltd.
Stephens Belting Co., Ltd.

11 Bin Dischargers
Appareils vide-coffres
Behälterentlader
Descargadoras de depósitos
W. S. Barron & Son, Ltd.
Bennis Combustion, Ltd.
F. E. Callow (Engineers), Ltd.
R. H. Corbett & Co., Ltd.
Merrick Scale Manufacturing Co., Ltd
M.G.K. Engineering Co., Ltd.
Mucon Engineering Co., Ltd.
Powell Duffryn Engineering Co., Ltd.
Redler Conveyors, Ltd.
Rendale Conveyors, Ltd.

Richardson Scale Co., Ltd.
Thomas Robinson & Son, Ltd.
Service Engineering Co. (Northampton)
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Winget, Ltd.

12 Bottle Packing Machines
Machines d'emballage des bouteilles
Flaschenverpackungsmaschinen
Màquinas Embaladoras de Botellas
Decker Equipment & Lifts, Ltd.

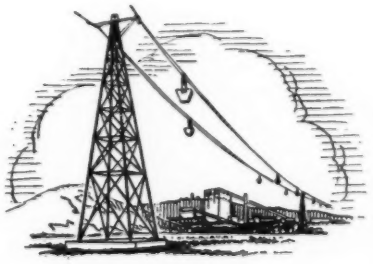
13 Boxes and Cases
Boîtes et caisses
Kisten und Kästen
Cajas y cajones
British Metal Crates, Ltd.
Fiorina Engineering Co., Ltd.
The Lampeter Timber & Trading Co., Ltd.
Lee Cases, Ltd.
Light Alloy Construction, Ltd.
Salisbury Precision Engineering, Ltd.
West Dock Timber Co., Ltd.
White Child & Beney, Ltd.

14 Bulk Handling Equipment
Matériel de manutention en vrac
Schüttgutförderer
Equipos para el manipuleo en masa
Abisch Conveyor & Furnace Co., Ltd.
Babcock, & Wilcox, Ltd.
Bagshawe, & Co., Ltd.
W. S. Barron & Son, Ltd.
Bennis Combustion, Ltd.
E. Boydell & Co., Ltd.
British Ropeway Engineering Co., Ltd.
British Wedge Wire Co., Ltd.
F. E. Callow (Engineers), Ltd.
Caterpillar Tractor Co., Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Drag Scraper Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
C. J. R. Fyson & Son
Gardiner's Conveyors, Ltd.
Holland Cranes
G. Hunter (London), Ltd.
International Combustion Products, Ltd.
C. H. Johnson (Machinery), Ltd.
Light Alloy Construction, Ltd.
Mann (Handling), Ltd.
Merrick Scale Manufacturing Co., Ltd.
The Mining Engineering Co., Ltd.
Mitchell Engineering, Ltd.
Herbert Morris, Ltd.
Mucon Engineering Co., Ltd.
Paterson Hughes Engineering Co., Ltd.
Powell Duffryn Engineering Co., Ltd.
Pressoturn, Ltd.
Promecon Manufacturing Co., Ltd.
Redler Conveyors, Ltd.
Rendale Conveyors, Ltd.
Richardson Scale Co., Ltd.
Thomas Robinson & Son, Ltd.
Ross Engineers, Ltd.
Rownsons (Conveyors), Ltd.
Salisbury Precision Engineering, Ltd.
Sheepbridge Equipment, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Stanhay (Ashford), Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.
T. & T. Works, Ltd.
Universal Conveyor Co., Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Thos. W. Ward, Ltd.
Winget, Ltd.
Hugh Wood & Co., Ltd.

15 Bulldozers and Angledozers
Bulldozers et Angledozers
Bulldozer und Seitenräumer
Bulldozers y empuja doras en angulo
Bray Construction Equipment, Ltd.
David Brown Industries, Ltd.
Caterpillar Tractor Co., Ltd.
Rubery, Owen & Co., Ltd.
Thos. W. Ward, Ltd.

16 Bunkers
Soutes
Bunker
Arcones y tanques de almacenaje
Abisch Conveyor & Furnace Co., Ltd.
Babcock & Wilcox, Ltd.
Bennis Combustion, Ltd.
C.P.C. (Southampton), Ltd.
F. E. Callow (Engineers), Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
C. J. R. Fyson & Son
Mitchell Engineering, Ltd.
Rendale Conveyors, Ltd.
Ross Engineers, Ltd.
Sheepbridge Equipment, Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.
T. & T. Works, Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Thos. W. Ward, Ltd.
Hugh Wood & Co., Ltd.

17 Cableways and Ropeways
Funiculaires et téléfériques
Seillaufbahnen
Cablevías y tranvias aeros
British Ropeway Engineering Co., Ltd.
Drag Scraper & Conveyor Co., Ltd.
Mitchell Engineering Co., Ltd.
Ropeways, Ltd.



18 Castors
Roulettes
Laufrollen
Ruedas de pivote
The Angel Truck Co., Ltd.
Autoset (Production), Ltd.
Compressed Rubber Products, Ltd.
Flexello Castors & Wheels, Ltd.
F. Piper & Sons, Ltd.
Rack Engineering, Ltd.
H. C. Slingsby, Ltd.
Tuglift, Ltd.
Willmot Trucks, Ltd.

19 Chains
Chaines
Ketten
Cadenas
Bagshawe & Co., Ltd.
George Cohen Sons & Co., Ltd.
Ewart Chainbelt Co., Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Herbert Morris, Ltd.
Morse Chain Division & Hartcliffe Chains Division of Borg-Warner, Ltd.
Rendale Conveyors, Ltd.
Renold Chains, Ltd.
S. S. Stott, Ltd.
Webb Conveyors & Automation, Ltd.
Wheway Watson & McLean, Ltd.

20 Coal Handling Equipment
Matériel de manutention du charbon
Kohlenförderanlagen
Equipos para el manipuleo de carbón
Abisch Conveyor & Furnace Co., Ltd.
Babcock & Wilcox, Ltd.
Bagshawe & Co., Ltd.
Bennis Combustion, Ltd.
E. Boydell & Co., Ltd.
Bray Construction Equipment, Ltd.
British Ropeway Engineering Co., Ltd.
British Wedge Wire Co., Ltd.
C.P.C. (Southampton), Ltd.
Caterpillar Tractor Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Drag Scraper & Conveyor Co., Ltd.
Electro-Hydraulics, Ltd.
Ewart Chainbelt Co., Ltd.
Gordon Felber & Co., Ltd.
Fisher & Ludlow, Ltd.
C. J. R. Fyson & Son
Industrial Machine Equipment Co. (Brimpex), Ltd.
International Combustion Products, Ltd.
C. H. Johnson (Machinery), Ltd.
Lodematic, Ltd.
Mann (Handling), Ltd.
The Mining Engineering Co., Ltd.
Mitchell Engineering, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Redler Conveyors, Ltd.
Rendale Conveyors, Ltd.
Service Engineering Co. (Northampton), Ltd.
Sheepbridge Equipment, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Stanhay (Ashford), Ltd.
S. S. Stott, Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.
Universal Conveyor Co., Ltd.
Thos. W. Ward, Ltd.
West's Group of Industries
Westwood Dawes & Co., Ltd.
Winget, Ltd.
Hugh Wood & Co., Ltd.

21 Coil Handling & Feeding Equipment
Matériel de manutention et d'alimentation pour rouleaux (fil, etc.)
Kohlenförder- und Schuttanlagen
Equipos para el manipuleo y alimentación de rollos

Abisch Conveyor & Furnace Co., Ltd.
Bagshawe & Co., Ltd.
R. H. Corbett & Co., Ltd.
Ewart Chainbelt Co., Ltd.
Albert Mann Engineering Co., Ltd.
Omic, Ltd.
Rapid Magnetic, Ltd.
Rendale Conveyors, Ltd.
Stephens Belting Co., Ltd.

22 Colliery Tub Handling
Manutention de bennes de houillére
Zechen-Förderwagen
Instalacionés para manipuleo de cajones en minas de carbón

Bennis Combustion, Ltd.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
Mann (Handling), Ltd.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
Richard Sutcliffe, Ltd.
Westinghouse Brake & Signal Co., Ltd.

23 Control Gear
Mécanismes de commande
Steuergeräte
Aparatos de mando

Brookhirst Igranic, Ltd.
Diac, Ltd.
Dowty Hydraulic Units, Ltd.
Dowty Seals, Ltd.
E.M.S. Electrical Products, Ltd.
Electro-Hydraulics, Ltd.
The English Electric Co., Ltd.
Hydraulics & Pneumatics, Ltd.
Lang Pneumatic, Ltd.
Albert Mann Engineering Co., Ltd.
Maxam Power, Ltd.
Merrick Scale Manufacturing Co., Ltd.
The Metal Box Co., Ltd.
Mucon Engineering Co., Ltd.
Promecon Manufacturing Co., Ltd.
Richardson Scale Co., Ltd.
Sharp Control Gear, Ltd.
Stein Atkinson Vickers Hydraulics, Ltd.
Teleflex Products, Ltd.
Westinghouse Brake & Signal Co., Ltd.
West's Group of Industries

24 Conveyor Belt Repair Materials
Fournitures pour réparations de transporteurs à courroie
Förderriemen-Reparaturmaterial
Materiales para reparación de transportadores a correa

Abisch Conveyor & Furnace Co., Ltd.
Barrow Hepburn & Gale, Ltd.

25 Conveyor Buckets
Godets de transporteur
Förderkübel
Palas y cangilones de transportador

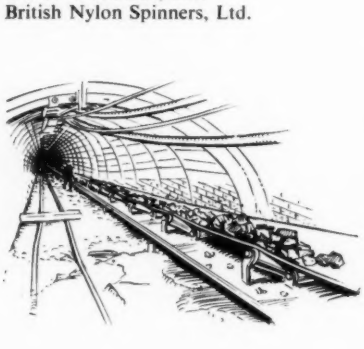
Babcock & Wilcox, Ltd.
Bagshawe & Co., Ltd.
Bennis Combustion, Ltd.
British MonoRail, Ltd.
British Ropeway Engineering Co., Ltd.
F. E. Callow (Engineers), Ltd.
Ewart Chainbelt Co., Ltd.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
Spencer (Melksham), Ltd.
E. Stephens & Son, Ltd.
S. S. Stott, Ltd.
Richard Sutcliffe, Ltd.
West's Group of Industries
Westwood Dawes & Co., Ltd.

26 Conveyor Driving Heads
Groupes de commande de transporteurs
Antriebsköpfe
Cabezales motores para transportadores

Abisch Conveyor & Furnace Co., Ltd.
Bagshawe & Co., Ltd.
Bennis Combustion, Ltd.
Crofts (Engineers), Ltd.
Crone & Taylor (Engineering), Ltd.
Finspa Engineering Co., Ltd.
C. J. R. Fyson & Son
Gardiner's Conveyors, Ltd.
Gimson & Co. (Leicester), Ltd.
C. H. Johnson (Machinery), Ltd.
William Kenyon & Sons, Ltd.
Albert Mann Engineering Co., Ltd.
Mann (Handling), Ltd.
The Mining Engineering Co., Ltd.
Mitchell Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Richards Structural Steel Co., Ltd.
Spencer (Melksham), Ltd.
Stephens Belting Co., Ltd.
Richard Sutcliffe, Ltd.
Universal Conveyor Co., Ltd.
Thos. W. Ward, Ltd.
Hugh Wood & Co., Ltd.

27 Conveyors (all types)
Transporteurs (tous types)
Förderer (aller Art)
Transportadores (todos tipos)

Abisch Conveyor & Furnace Co., Ltd.
The Angel Truck Co., Ltd.
Babcock & Wilcox, Ltd.
Bagshawe & Co., Ltd.
W. S. Barron & Son, Ltd.
Bennis Combustion, Ltd.
British MonoRail, Ltd.
British Nylon Spinners, Ltd.



British Ropeway Engineering Co., Ltd.
British Wedge Wire Co., Ltd.
F. E. Callow (Engineers), Ltd.
William E. Cary, Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Conveyors (Readybuilt), Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Dexion, Ltd.
Diac, Ltd.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
Gordon Felber & Co., Ltd.
Felco Hoists, Ltd.
Finspa Engineering Co., Ltd.
Fisher & Ludlow, Ltd.
Fourways (Engineers), Ltd.
C. J. R. Fyson & Son
Gardiner's Conveyors, Ltd.
Geo. H. Gascoigne Co., Ltd.
Gimson & Co. (Leicester), Ltd.
The Goodyear Tyre & Rubber Co. (Gt. Britain), Ltd.
Grading Machinery, Ltd.
Harrold, Ltd.
Helicoid Flight Conveyors, Ltd.
G. Hunter (London), Ltd.
International Combustion Products, Ltd.
C. H. Johnson (Machinery), Ltd.
Geo. W. King, Ltd.
Lamson Engineering Co., Ltd.
Albert Mann Engineering Co., Ltd.
Mann (Handling), Ltd.
Manufacturers Equipment Co., Ltd.
A. L. Marshall (Carlton), Ltd.
The Metal Box Co., Ltd.
The Mining Engineering Co., Ltd.
Mitchell Engineering Co., Ltd.
Herbert Morris, Ltd.
Morse Chain Division & Hartcliffe Chains Division of Borg-Warner, Ltd.
Numec, Ltd.
Omic, Ltd.
Paterson Hughes Engineering Co., Ltd.
Promecon Manufacturing Co., Ltd.
Redler Conveyors, Ltd.
Rendale Conveyors, Ltd.
Thomas Robinson & Son, Ltd.
Ropeways, Ltd.
Rownsons (Conveyors), Ltd.
Salisbury Precision Engineering, Ltd.
Scottish Mechanical Light Industries, Ltd.
Sheepbridge Equipment, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Stephens Belting Co., Ltd.
Stewart Gill & Co., Ltd.
S. S. Stott, Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.
T. & T. Works, Ltd.
Teleflex Products, Ltd.
Universal Conveyor Co., Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Vac-U-Lift (Great Britain), Ltd.
Thos. W. Ward, Ltd.
Webb Conveyors & Automation, Ltd.
West's Group of Industries
Westwood Dawes & Co., Ltd.
Wharton Engineers (Elstree), Ltd.
Wheway Watson & McLean, Ltd.
Witlor, Ltd.
Hugh Wood & Co., Ltd.
W. C. Youngman, Ltd.

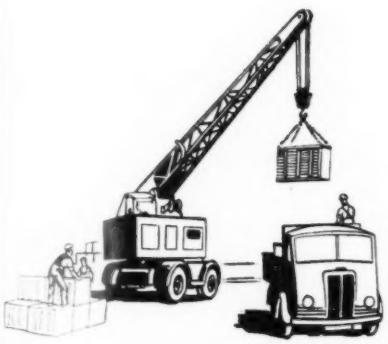
28 Cranes (Jib)
Grues (à flèche)
Auslagerkräne
Grúas (de pluma)

Acrow (Engineers), Ltd.
The Angel Truck Co., Ltd.
Babcock & Wilcox, Ltd.
British MonoRail, Ltd.

Butters Bros. & Co., Ltd.
Didsbury Engineering Co., Ltd.
Felco Hoists, Ltd.
Grafton Cranes, Ltd.
Holland Cranes
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Leverton & Co., Ltd.
Mitchell Engineering Co., Ltd.
Herbert Morris, Ltd.
Fred Myers, Ltd.
R. H. Neal & Co., Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Thos. Smith & Sons (Rodley), Ltd.
Tower Cranes, Ltd.
Vac-U-Lift (Great Britain), Ltd.
Thos. W. Ward, Ltd.
Wilor, Ltd.

29 Cranes (Mobile)
Grues (mobiles)
Fahrkräne
Grúas (móviles)

Anderston Clyde Engineers, Ltd.
British Hoist & Crane Co., Ltd.
George Cohen Sons & Co., Ltd.



Conveyancer Fork Trucks, Ltd.
G. Hunter (London), Ltd.
Leverton & Co., Ltd.
Herbert Morris, Ltd.
Fred Myers, Ltd.
R. H. Neal & Co., Ltd.
Priestman Bros., Ltd.
Ransomes & Rapier, Ltd.
Thos. Smith & Sons (Rodley), Ltd.
Stanhay (Ashford), Ltd.
Steels Engineering Products, Ltd.
F. Taylor & Sons (Manchester), Ltd.
Tower Cranes, Ltd.
Tunny Cranes, Ltd.
Thos. W. Ward, Ltd.
Wilor, Ltd.

30 Cranes (Overhead)
Grues (à pont roulant)
Laufkräne
Grúas (de puente)

Acrow (Engineers), Ltd.
Anderston Clyde Engineers, Ltd.
Babcock & Wilcox, Ltd.
British Electrical Repairs, Ltd.
British MonoRail, Ltd.
Butters Bros. & Co., Ltd.
George Cohen Sons & Co., Ltd.
Dolly Cranes, Ltd.
Felco Hoists, Ltd.
Holland Cranes
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Matterson, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Strachan & Henshaw, Ltd.
Tower Cranes, Ltd.
Vac-U-Lift (Great Britain), Ltd.
Thos. W. Ward, Ltd.
Westwood Dawes & Co., Ltd.

31 Cranes (Workshop)
Grues (d'atelier)
Werkstattkräne
Grúas (de taller)

Acrow (Engineers), Ltd.
Anderston Clyde Engineers, Ltd.
British Electrical Repairs, Ltd.
British Hoist & Crane Co., Ltd.
British MonoRail, Ltd.
Butters Bros. & Co., Ltd.
George Cohen Sons & Co., Ltd.
Epco, Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Leverton & Co., Ltd.
Matterson, Ltd.
Herbert Morris, Ltd.
Fred Myers, Ltd.
R. H. Neal & Co., Ltd.
Rendale Conveyors, Ltd.
Tower Cranes, Ltd.
Vac-U-Lift (Great Britain), Ltd.
Thos. W. Ward, Ltd.

32 Current Collection Equipment
Equipement de prise de courant
Stromabnehmer
Equipos de toma de corriente

Acrow (Engineers), Ltd.
British MonoRail, Ltd.
E.M.S. Electrical Products, Ltd.

34 Drag Scrapers
Scrapers à câble
Schleppschrapper
Traillas o palas a cable de arrastre

British Ropeway Engineering Co., Ltd.
Caterpillar Tractor Co., Ltd.
Crone & Taylor (Engineering), Ltd.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
Gardiner's Conveyors, Ltd.
International Combustion Products, Ltd.
Herbert Morris, Ltd.
Rendale Conveyors, Ltd.
Spencer (Melksham), Ltd.
Tower Cranes, Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.

35 Draughting & Technical Illustration & Equipment
Equipement pour le dessin et l'illustration techniques
Zeichenmaschinen
Diseño e ilustración técnica

Dargue Bros., Ltd.
Promecon Manufacturing Co., Ltd.
Technivision, Ltd.

36 Dumpers
Déchargeurs à bascule
Schüttwagen
Volteadoras

The Angel Truck Co., Ltd.
E. Boydell & Co., Ltd.
Caterpillar Tractor Co., Ltd.
R. H. Corbett & Co., Ltd.
Douglas Equipment, Ltd.
G. Hunter (London), Ltd.
C. H. Johnson (Machinery), Ltd.
Powell Duffryn Engineering Co., Ltd.
Salisbury Precision Engineering, Ltd.
R. Smith (Horley), Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.

36a Dust Control Equipment
Matériel anti-poussières
Staubkontrollousrüstung
Equipos de control de polvos

Dallow Lambert & Co., Ltd.

37 Electric Motors
Moteurs électriques
Elektromotoren
Motores eléctricos

Acrow (Engineers), Ltd.
Associated Electrical Industries, Ltd.
British Electrical Repairs, Ltd.
C.A.V., Ltd.
Electropower Gears, Ltd.
The English Electric Co., Ltd.
Neco Geared Motors, Ltd.
Normand Electrical Co., Ltd.

39 Electronic Control Equipment
Equipement vibratoire électrique
Elektr. Schwingungsvorrichtungen
Equipos vibratorios eléctricos

Associated Electrical Industries, Ltd.
Brookhirst Igranic, Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
The English Electric Co., Ltd.
Albert Mann Engineering Co., Ltd.
Merrick Scale Manufacturing Co., Ltd.
The Metal Box Co., Ltd.
Promecon Manufacturing Co., Ltd.
Richardson Scale Co., Ltd.
Thomas Robinson & Sons, Ltd.
Richard Sutcliffe, Ltd.
Webb Conveyors & Automation, Ltd.

40 Elevators
Elévateurs
Hebewerke
Elevadores

Abisch Conveyor & Furnace Co., Ltd.
The Angel Truck Co., Ltd.
Babcock & Wilcox, Ltd.
Bagshawe & Co., Ltd.
W. S. Barron & Son, Ltd.
Becker Equipment & Lifts, Ltd.
Bennis Combustion, Ltd.
British Wedge Wire Co., Ltd.
F. E. Callow (Engineers), Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
C. J. R. Fyson & Son
Gandy, Ltd.

Gardiner's Conveyors, Ltd.
Gimson & Co. (Leicester), Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
International Combustion Products, Ltd.
Lamson Engineering Co., Ltd.
Lenson Engineering Co.
Locker Industries, Ltd.
Lodematic, Ltd.
Mann (Handling), Ltd.
A. L. Marshall (Carlton), Ltd.
The Metal Box Co., Ltd.
Herbert Morris, Ltd.
Morse Chain Division & Hartcliffe Chains Division of Borg-Warner, Ltd.
Paterson Hughes Engineering Co., Ltd.
Powell & Co.
Rapid Magnetic, Ltd.
Rendale Conveyors, Ltd.
Rownsons (Conveyors), Ltd.
Scottish Mechanical Light Industries, Ltd.
Sheepbridge Equipment, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Stephens Belting Co., Ltd.
Stewart Gill & Co., Ltd.
S. S. Stott, Ltd.
Richard Sutcliffe, Ltd.
T. & T. Works, Ltd.
Teleflex Products, Ltd.
Universal Conveyor Co., Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Thos. W. Ward, Ltd.
Webb Conveyors & Automation, Ltd.
West's Group of Industries
Westwood Dawes & Co., Ltd.
Wharton Engineers (Elstree), Ltd.

41 Engines (Diesel/Petrol)
Moteurs (Diesel/essence)
Motoren (Diesel/-, Benzin)
Motores (Diesel/gasolina)
Caterpillar Tractor Co., Ltd.
The English Electric Co., Ltd.
Ford Motor Co., Ltd. (Parts Div.)
Ford Motor Co., Ltd. (Tractor Div.)
Perkins Engines, Ltd.

42 Fixing Devices
Dispositifs de fixation
Befestigungsvorrichtungen
Dispositivos para fijación
Autoset (Production), Ltd.
F'Ag Bearing Co., Ltd.
Hydraulics & Pneumatics, Ltd.
The Rawlplug Co., Ltd.
Stephens Belting Co., Ltd.

44 Gears
Engrenages
Getriebe
Engranajes
Allspeeds, Ltd.
Associated Electrical Industries, Ltd.
David Brown Industries, Ltd.
Butters Bros. & Co., Ltd.
Cordey-Thomson
Crofts (Engineers), Ltd.
Electropower Gears, Ltd.
Ewart Chainbelt Co., Ltd.
Gimson & Co. (Leicester), Ltd.
Highfield Gear & Engineering Co., Ltd.
John Holroyd & Co., Ltd.
William Kenyon & Sons, Ltd.
Albert Mann Engineering Co., Ltd.
The Moss Gear Co., Ltd.
NECO Geared Motors, Ltd.
Normand Electrical Co., Ltd.
The Northern Manufacturing Co., Ltd.
S. E. Opperman, Ltd.
Salisbury Precision Engineering, Ltd.
Self-Changing Gears, Ltd.
Varatio-Strateline Gears, Ltd.
Alfred Wiseman, Ltd.

45 Grabs
Bennes preneuses
Greifer
Cucharas de agarre
Acrow (Engineers), Ltd.
British Electrical Repairs, Ltd.
Holland Cranes
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Priestman Bros., Ltd.
F. Taylor & Sons (Manchester), Ltd.
Tower Cranes, Ltd.

46 Hoists (Hand Operated)
Appareils de levage (à main)
Aufzüge (für den Handbetrieb)
Aparejos elevadores (accionados a mano)
Acrow (Engineers), Ltd.
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Didsbury Engineering Co., Ltd.
Epco, Ltd.
Felco Hoists, Ltd.
Gimson & Co. (Leicester), Ltd.
G. Hunter (London), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Geo. W. King, Ltd.
Lang Pneumatic, Ltd.
Lenson Engineering Co.
Lodematic, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Powell & Co.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
T. & T. Works, Ltd.
Tirfor, Ltd.
The Yale & Towne Manufacturing Co.

47 Hoists (Power Operated)
Appareils de levage (Motorisés)
Aufzüge (mit Motorantrieb)
Aparejos elevadores (accionados a motor)
Acrow (Engineers), Ltd.
The Angel Truck Co., Ltd.
Babcock & Wilcox, Ltd.
W. S. Barron & Son, Ltd.
Becker Equipment & Lifts, Ltd.
Bennis Combustion, Ltd.
British Hoist & Crane Co., Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Drag Scraper & Conveyor Co., Ltd.
Felco Hoists, Ltd.
Gimson & Co. (Leicester), Ltd.
G. Hunter (London), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Geo. W. King, Ltd.
Lang Pneumatic, Ltd.
Laycock Engineering Co., Ltd.
Lenson Engineering Co.
Lodematic, Ltd.
Martonair, Ltd.
Matterson, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Powell & Co.
Rendale Conveyors, Ltd.
Spencer (Melksham), Ltd.
T. & T. Works, Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Varatio-Strateline Gears, Ltd.
The Yale & Towne Manufacturing Co.

48 Hydraulic Equipment
Equipement Hydraulique
Hydraulische Geräte
Equipos hidráulicos
Access Equipment, Ltd.
Anderston Clyde Engineers, Ltd.
Baldwin Industrial Controls
Barrow Hepburn & Gale, Ltd.
Becker Equipment & Lifts, Ltd.
Bray Construction Equipment, Ltd.
Conveyancer Fork Trucks, Ltd.
Dowty Hydraulic Units, Ltd.
Dowty Seals, Ltd.
Electro-Hydraulics, Ltd.
Epco, Ltd.
Hamworthy Engineering, Ltd.
G. Hunter (London), Ltd.
Hydraulics & Pneumatics, Ltd.
Keelavite Hydraulics, Ltd.
Joseph Lucas (Hydraulic & Combustion Equipment), Ltd.
Albert Mann Engineering Co., Ltd.
Martonair, Ltd.
Maxam Power, Ltd.
The Plessey Co., Ltd.
Powell & Co.
Power Jacks, Ltd.
Promecon Manufacturing Co., Ltd.
Salisbury Precison Engineering, Ltd.
Service Engineering Co. (Northampton), Ltd.
S. Smith & Sons (England), Ltd.
Spenborough Engineering Co., Ltd.
Stein Atkinson Vickers Hydraulics, Ltd.
Super Oil Seals & Gaskets, Ltd.
Richard Sutcliffe, Ltd.
Tower Cranes, Ltd.
Weston Works (Birmingham), Ltd.
Winget, Ltd.

49 Idlers
Roues et poulies intermediaires
Umlenkrollen, Spannrollen
Ruedas y poleas intermediarias
Bagshawe & Co., Ltd.
Crone & Taylor (Engineering), Ltd.
Ewart Chainbelt Co., Ltd.
Fisher & Ludlow, Ltd.
C. H. Johnson (Machinery), Ltd.
The Mining Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Richard Sutcliffe, Ltd.
Universal Conveyor Co., Ltd.
West's Group of Industries
Westwood Dawes & Co., Ltd.
Hugh Wood & Co., Ltd.

50 Ignition Accessories
Accessoires pour l'allumage
Zündzubehör
Accesorios de ignición
Associated Electrical Industries, Ltd.
S. Smith & Sons (England), Ltd.

51 **Inspection**
Visite (inspection, vérification)
Kontrolle
Inspecciones
G. Hunter (London), Ltd.
Vac-U-Lift (Great Britain), Ltd.

52 **Jacks (Lifting and/or Pulley)**
Crics et vérins (à levier et/ou à poulie)
Hebeböcke
Gatos (alzadores o de poleas)
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Electro-Hydraulics, Ltd.
Epco, Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Hydraulics & Pneumatics, Ltd.
Matterson, Ltd.
Power Jacks, Ltd.
Rubber By-Products (Warwickshire), Ltd.
Salisbury Precision Engineering, Ltd.
S. Smith & Sons (England), Ltd.
Spenborough Engineering Co., Ltd.
Tirfor, Ltd.

53 **Ladders**
Echelles
Leitern
Escaleras
Anderston Clyde Engineers, Ltd.
The Angel Truck Co., Ltd.
Antifyre, Ltd.
Kimbell Machine Tools, Ltd.
The Lampeter Timber & Trading Co., Ltd.
Lenson Engineering Co.
Light Alloy Construction, Ltd.
H. C. Slingsby, Ltd.
W. C. Youngman, Ltd.

54 **Lifts**
Ascenseurs
Aufzüge
Ascensores
Access Equipment, Ltd.
Anderston Clyde Engineers, Ltd.
The Angel Truck Co., Ltd.
Becker Equipment & Lifts, Ltd.
Gimson & Co. (Leicester), Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Lamson Engineering Co., Ltd.
Laycock Engineering Co., Ltd.
Lodematic, Ltd.
Herbert Morris, Ltd.
Powell & Co.
Rendale Conveyors, Ltd.
Vac-U-Lift (Great Britain), Ltd.

55 **Lock Nuts**
Ecrous indésserrables
Klemmuttern
Tuercas de sujeción
F'Ag Bearing Co., Ltd.
Guest Keen & Nettlefolds (Midlands), Ltd.
Rubery Owen & Co., Ltd.

56 **Locomotives (For Use in Coal Mines)**
Locomotives (pour les houillères)
Lokomotiven (für den Zechenbetrieb)
Locomotoras (para uso en minas de carbón)
Associated Electrical Industries, Ltd.
The English Electric Co., Ltd.
Hugh Wood & Co., Ltd.

57 **Lorry Loaders**
Chargeours de camions
Wagenlader
Cargadoras de camiones
Abisch Conveyor & Furnace Co., Ltd.
Access Equipment, Ltd.
The Angel Truck Co., Ltd.
Becker Equipment & Lifts, Ltd.
Cargon Transport (Great Britain), Ltd.
Caterpillar Tractor Co., Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
R. H. Corbett & Co., Ltd.
Felco Hoists, Ltd.
Fourways (Engineers), Ltd.
G. Hunter (London), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Laycock Engineering Co., Ltd.
Lodematic, Ltd.
R. H. Neal & Co., Ltd.
Powell & Co.
Powell Duffryn Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Salisbury Precision Engineering, Ltd.
Service Engineering Co. (Northampton), Ltd.
Sheepbridge Equipment, Ltd.
Stanhay (Ashford), Ltd.

58 **Lubricants**
Lubrifiants
Schmiermittel
Lubricantes
Matling, Ltd.
Revol, Ltd.

59 **Lubricating Equipment**
Matériel de graissage
Schmiergeräte
Equipos de lubricación
Associated Electrical Industries, Ltd.

60 **Office Machines**
Machines de bureau
Büromaschinen
Máquinas para oficinas
Adrema, Ltd.

60a **Packaging Equipment**
Matériel d'emballage
Verpackungsbedarf
Equipos para embalaje
The Thames Packaging Equipment Co.

61 **Pallets**
Palettes
Pallets
Paletas
The Angel Truck Co., Ltd.
Bennis Combustion, Ltd.
British Metal Crates, Ltd.
P. C. & C. K. Chase, Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Conveyancer Fork Trucks, Ltd.
Eccles (Birmingham), Ltd.
Ewart Chainbelt Co., Ltd.
Finspa Engineering Co., Ltd.
Fisher & Ludlow, Ltd.
Geest Industries, Ltd.
G. Hunter (London), Ltd.
Kimbell Machine Tools, Ltd.
The Lampeter Timber & Trading Co., Ltd.
Lansing Bagnall, Ltd.
Lawton (Successors), Ltd.
Lee Cases, Ltd.
Lenson Engineering Co.
Light Alloy Construction, Ltd.
M.G.K. Engineering Co., Ltd.
Mann (Handling), Ltd.
A. L. Marshall (Carlton), Ltd.
Metal Products (Arden), Ltd.
Omic, Ltd.
Penfold Fencing & Engineering, Ltd.
F. Piper & Sons, Ltd.
Charles Pitt (Barton Stacey), Ltd.
Rendale Conveyors, Ltd.
Rubery Owen & Co., Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
E. Stephens & Sons, Ltd.
S. S. Stott, Ltd.
Superbuilt Products, Ltd.
Richard Sutcliffe, Ltd.
Tilgate Saw Mills, Ltd.
Tubewrights, Ltd.
Tublift, Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
West Dock Timber Co., Ltd.
Willmot Trucks, Ltd.
W. C. Youngman, Ltd.

62 **Pallet Loaders**
Chargeours de palettes
Palletlader
Cargadoras de paletas
Becker Equipment & Lifts, Ltd.
Bennis Combustion, Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
R. H. Corbett & Co., Ltd.
Gimson & Co. (Leicester), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Lodematic, Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Paterson Hughes Engineering Co., Ltd.
Powell & Co.
Rack Engineering, Ltd.
Vac-U-Lift (Great Britain), Ltd.

64 **Pneumatic Handling Plant**
Matériel de manutention pneumatique
Druckluftbezeuge Druk- und Saugluftförderer
Instalacionés de manipuleo neumatico
Abisch Conveyor & Furnace Co., Ltd.
Babcock & Wilcox, Ltd.
Baldwin Industrial Controls
F. E. Callow (Engrs.), Ltd.
Sir George Godfrey & Partners (Industrial), Ltd.
Holland Cranes
Hydraulics & Pneumatics, Ltd.
Lamson Engineering Co., Ltd.
Albert Mann Engineering Co., Ltd.
Maxam Power, Ltd.
Paterson Hughes Engineering

Promecon Manufacturing Co., Ltd.
Rendale Conveyors, Ltd.
Thomas Robinson & Son, Ltd.
A. Schrader's Son
Scottish Mechanical Light Industries, Ltd.
Simon Handling Engineers, Ltd.
Spencer (Melksham), Ltd.
Vac-U-Lift (Great Britain), Ltd.
Thos. W. Ward, Ltd.
Westinghouse Brake & Signal Co., Ltd.
Winget, Ltd.

65 Pneumatic Tubes
Systèmes de tubes pneumatiques
Saugrohre
Tubos neumáticos
Dialled Despatches, Ltd.
Lamson Engineering Co., Ltd.

66 Power Transmission Equipment (Including Gears and Fluid Drives)
Matériel de transmission de puissance (Y compris engrenages et transmission par fluides)
Kraftübertragungsmittel (einschliesslich Zahnrad- und Flüssigkeitsgetriebe)
Equipos de transmisión de fuerza (inclusive engranajes y transmisiones a fluido)
Barrow, Hepburn & Gale, Ltd.
Brockhouse Engineering, Ltd.
W. E. Burnand & Son, Ltd.
Carter Gears, Ltd.
Cordey-Thomson
Crofts (Engineers), Ltd.
Dowty Hydraulic Units, Ltd.
Dowty Seals, Ltd.
E.M.S. Electrical Products, Ltd.
Electropower Gears, Ltd.
Fluidrive Engineering Co., Ltd.
Gandy, Ltd.
Highfield Gear & Engineering Co., Ltd.
John Holroyd & Co., Ltd.
William Kenyon & Sons, Ltd.
Joseph Lucas (Hydraulic & Combustion Equipment), Ltd.
Morse Chain Division & Hartcliffe Chains Division of Borg-Warner, Ltd.
NECO Geared Motors, Ltd.
Normand Electrical Co., Ltd.
S. E. Opperman, Ltd.
Rapid Magnetic, Ltd.
Renold Chains, Ltd.
Self-Changing Gears, Ltd.
S. Smith & Sons (England), Ltd.
Stein Atkinson Vickers Hydraulics, Ltd.
Stephens Belting Co., Ltd.
Varatio-Strateline Gears, Ltd.

67 Pulley Blocks (Hand Operated)
Moufles (à bras)
Flaschenzüge (für den Handbetrieb)
Poleas multiples (accionadas a mano)
Acrow (Engineers), Ltd.
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
Didsbury Engineering Co., Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
The Yale & Towne Manufacturing Co.

68 Pulley Blocks (Power Operated)
Moufles (motorisés)
Flaschenzüge (mit Kraftantrieb)
Poleas múltiples (accionadas a motor)
Acrow (Engineers), Ltd.
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Geo. W. King, Ltd.
Matterson, Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Thos. W. Ward, Ltd.
The Yale & Towne Manufacturing Co.

69 Pumps
Pompes
Pumpen
Bombas
Associated Electrical Industries, Ltd.
B.T.R. Industries, Ltd.
David Brown Industries, Ltd.
C.A.V., Ltd.
Conveyancer Fork Trucks, Ltd.
Hamworthy Engineering, Ltd.
Hydraulics & Pneumatics, Ltd.
International Combustion Products, Ltd.
C. H. Johnson (Machinery), Ltd.
Joseph Lucas (Hydraulic & Combustion Equipment), Ltd.
Mono Pumps, Ltd.
Oddy Engineering, Ltd.
The Plessey Co., Ltd.
Power Jacks, Ltd.
Ransomes & Rapier, Ltd.
Salisbury Precision Engineering, Ltd.
S. Smith & Sons (England), Ltd.
Spenborough Engineering Co., Ltd.
Spencer (Melksham), Ltd.
Stein Atkinson Vickers Hydraulics, Ltd.
Thos. W. Ward, Ltd.

70 Radiant Heat Equipment
Equipement de chaleur royannant
Heizkörper
Equipos de calor radiante
Associated Electrical Industries, Ltd.
Stewart Gill & Co., Ltd.

71 Ropes and Cables (All Descriptions)
Cordes et câbles (tous genres)
Seile und Kabel (aller Art)
Cuerdas y cables (de todo género)
British Nylon Spinners, Ltd.
G. Hunter (London), Ltd.
William Kenyon & Sons, Ltd.
Stephens Belting Co., Ltd.

72 Safe Load Indicators
Indicateurs de charge de sécurité
Belastungsanzeiger
Indicadores de carga de seguridad
Lansing Bagnall, Ltd.
Tower Cranes, Ltd.

73 Screens
Cribles et tamis
Abschirmungen
Cribas y tamices
Abisch Conveyor & Furnace Co., Ltd.
E. P. Allam & Co., Ltd.
W. S. Barron & Son, Ltd.
Bennis Combustion, Ltd.
British Wedge Wire Co., Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Electromagnets, Ltd.
C. J. R. Fyson & Son
Gimson & Co. (Leicester), Ltd.
International Combustion Products, Ltd.
Locker Industries, Ltd.
Rendale Conveyors, Ltd.
Thomas Robinson & Son, Ltd.
Ross Engineers, Ltd.
Russell Construction, Ltd.
Sheepbridge Equipment, Ltd.
Spencer (Melksham), Ltd.
Strachan & Henshaw, Ltd.
West's Group of Industries
Winget, Ltd.

74 Seals
Dispositifs d'étanchéité
Dichtungen
Cierres estancos
Associated Electrical Industries, Ltd.
BTR Industries, Ltd.
W. S. Barron & Son, Ltd.
F. E. Callow (Engineers), Ltd.
Hydraulics & Pneumatics, Ltd.
Silvertown Rubber Co., Ltd.
Strappings, Ltd.
Super Oil Seals & Gaskets, Ltd.

75 Services
Services
Dienstleistungen
Servicios
Antifyre, Ltd.
Cordey-Thomson
G.P.O. London Telecommunications Region
G. Hunter (London), Ltd.
The Institute of Materials Handling
E. G. Irwin & Partners, Ltd.
Zinc Alloy Rust Proofing Co., Ltd.

76 Shovels (Hydraulic and Mechanical)
Pelles (hydrauliques et mécanique)
Löffelbagger (hydraulische und mechanische)
Palas (hidráulicas y mecánicas)
Babcock & Wilcox, Ltd.
E. Boydell & Co., Ltd.

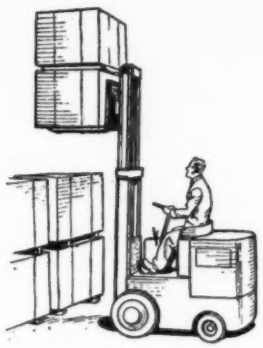
Bray Constructional Equipment, Ltd.
Caterpillar Tractor Co., Ltd.
Conveyancer Fork Trucks, Ltd.
G. Hunter (London), Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Matbro, Ltd.
Priestman Bros., Ltd.

Stanhay (Ashford), Ltd.
Tower Cranes, Ltd.
Thos. W. Ward, Ltd.
F. E. Weatherill, Ltd.
The Yale & Towne Manufacturing Co.

77 **Skip Hoists**
Skips
Kippaufzüge
Montacargas de cajón
Abisch Conveyor & Furnace Co., Ltd.
Babcock & Wilcox, Ltd.
Bamshawe & Co., Ltd.
Baxter Equipment & Lifts, Ltd.
Bennis Combustion, Ltd.
British Ropeway Engineering Co., Ltd.
British Wedge Wire Co., Ltd.
Robert Cort & Son, Ltd.
Crone & Taylor (Engineering), Ltd.
Cutler Conveyor Co.
Drag Scraper & Conveyor Co., Ltd.
Ewart Chainbelt Co., Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
International Combustion Products, Ltd.
Albert Mann Engineering Co., Ltd.
Mitchell Engineering Co., Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
Spencer (Melksham), Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.
T. & T. Works, Ltd.
Teleflex Products, Ltd.
Universal Conveyor Co., Ltd.
Thos. W. Ward, Ltd.
Webb Conveyors & Automation, Ltd.
West's Group of Industries

78 Slings
Elingues
Schlingen
Eslingas
Abisch Conveyor & Furnace Co., Ltd.
The Angel Trust Co., Ltd.
British Wedge Wire Co., Ltd.
George Cohen Sons & Co., Ltd.
Felco Hoists, Ltd.
Gandy, Ltd.
G. Hunter (London), Ltd.
Herbert Morris, Ltd.
F. Piper & Sons, Ltd.
Stephens Belting Co., Ltd.
Wheway Watson & McLean, Ltd.

80 Stackers
Empileurs
Stapler
Apiladoras
Abisch Conveyor & Furnace Co., Ltd.
Anderston Clyde Engineers, Ltd.
The Angel Truck Co., Ltd.
Bennis Combustion, Ltd.
J. Collis & Sons, Ltd.
R. H. Corbett & Co., Ltd.
Diac, Ltd.
Essex (Birmingham), Ltd.
C. J. R. Fyson & Son
Gardiner's Conveyors, Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Industrial Machine & Equipment Co. (Grimpex), Ltd.



C. H. Johnson (Machinery), Ltd.
Geo. W. King, Ltd.
Lansing Bagnall, Ltd.
Lodematic, Ltd.
A. L. Marshall (Carlton), Ltd.
Matling, Ltd.
Herbert Morris, Ltd.
Omic, Ltd.
Powell & Co.
Salisbury Precision Engineering, Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
Spencer (Melksham), Ltd.
Teleflex Products, Ltd.
Universal Conveyor Co., Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.

80a Steel Extrusions
Pièces métalliques refoulées
Stahl-Strangpresslinge
Extrusiones de acero
Alexander Marcar & Co., Ltd.

81 Steel Tubes
Tubes en acier
Stahlrohre
Tubos de acero
Accles & Pollock, Ltd.

82 Steel Strapping Machines
Machines à cercler au feuillard
Bandstahlbinder
Máquinas de precintar con flejes
Strappings, Ltd.

83 Stillages
Chantiers (pour fûts)
Transportbehälter
Caballetes y estantes
The Angel Truck Co., Ltd.
British Metal Crates, Ltd.
P. C. & C. K. Chase, Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Conveyancer Fork Trucks, Ltd.
R. H. Corbett & Co., Ltd.
Cutler Conveyor Co.
Diac, Ltd.
Finspa Engineering Co., Ltd.
Fisher & Ludlow, Ltd.
Geo. H. Gascoigne Co., Ltd.
Geest Industries, Ltd.
G. Hunter (London), Ltd.
Kimbell Machine Tools, Ltd.
The Lampeter Timber & Trading Co., Ltd.
Lansing Bagnall, Ltd.
Lawton (Successors), Ltd.
Lee Cases, Ltd.
Light Alloy Construction, Ltd.
M.G.K. Engineering Co., Ltd.
Mann (Handling), Ltd.
Albert Mann Engineering Co., Ltd.
A. L. Marshall (Carlton), Ltd.
Omic, Ltd.
Penfold Fencing & Engineering, Ltd.
F. Piper & Sons, Ltd.
Charles Pitt (Barton Stacey), Ltd.
Powell & Co.
Powell Duffryn Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Rubery Owen & Co., Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
E. Stephens & Son, Ltd.
Superbuilt Products, Ltd.
Richard Sutcliffe, Ltd.
Tilgate Saw Mills, Ltd.
Tuglift, Ltd.
V.M.E. Conveyor & Furnace Co., Ltd.
Thos. W. Ward, Ltd.
West Dock Timber Co., Ltd.
Willmot Trucks, Ltd.
W. C. Youngman, Ltd.

84 Storage Equipment
Matériel de conservation et d'emmagasinage
Lagerausrüstungen
Equipos para almacenaje
The Angel Truck Co., Ltd.
British Metal Crates, Ltd.
P. C. & C. K. Chase, Ltd.
Conveyancer Fork Trucks, Ltd.
R. H. Corbett & Co., Ltd.
Diac, Ltd.
Finspa Engineering Co., Ltd.
Fisher & Ludlow, Ltd.
Gardiner's Conveyors, Ltd.
Geo H. Gascoigne, Ltd.
J. Glover & Sons, Ltd.
Kimbell Machine Tools, Ltd.
Light Alloy Construction, Ltd.
M.G.K. Engineering Co., Ltd.
Mann (Handling), Ltd.
Mitchell Engineering Co., Ltd.
Omic, Ltd.
Powell & Co.
Rack Engineering, Ltd.
Rendale Conveyors, Ltd.
Rownsons (Conveyors), Ltd.
Rubery Owen & Co., Ltd.
E. Stephens & Son, Ltd.
Bertram Thomas (Engineer), Ltd.
Tubewrights, Ltd.
White, Child & Beney, Ltd.
W. C. Youngman, Ltd.

85 Straddle Carriers
Transporteurs bilatéreaux
Torladewagen
Transporta dores a horcajadas
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
Leverton & Co., Ltd.
Fred Myers, Ltd.
Materials Handling Equipment (Gt. Bt.), Ltd.

86 Telphers
Telphèrages
Elektrohängebahnen
Teleféricos
Acrow (Engineers), Ltd.
Babcock & Wilcox, Ltd.

Bennis Combustion, Ltd.
British MonoRail, Ltd.
British Ropeway Engineering Co., Ltd.
George Cohen Sons & Co., Ltd.
Drag Scraper & Conveyor Co., Ltd.
International Combustion, Ltd.
Matterson, Ltd.
Mitchell Engineering Co., Ltd.
Herbert Morris, Ltd.
Paterson Hughes Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Spencer (Melksham), Ltd.
Strachan & Henshaw, Ltd.

88 Tractors (All Types)
Tracteurs (tout types—Essence/Diesel/électriques)
Schlepper (aller Art—mit Benzin-, Diesel- oder Elektroantrieb)
Tractores (todos tipos—gasolina/Diesel/eléctricos)
The Angel Truck Co., Ltd.
Bray Construction Equipment, Ltd.
David Brown Industries, Ltd.
Brush Electrical Engineering Co., Ltd.
Caterpillar Tractor Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Douglas Equipment, Ltd.
Floataire, Ltd.
Ford Motor Co., Ltd.
Jewsbury's Mechanical Handling, Ltd.
Lansing Bagnall, Ltd.
Leverton & Co., Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Mercury Truck & Tractor Co., Ltd.
Montgomerie Reid Engineering Co., Ltd.
Fred Myers, Ltd.
Omic, Ltd.
Charles Pitt (Barton Stacey), Ltd.
Salisbury Precision Engineering, Ltd.
R. Smith (Horley), Ltd.
Tower Cranes, Ltd.
Wessex Industries (Poole), Ltd.
Wingrove & Roger, Ltd.
The Yale & Towne Manufacturing Co.
W. C. Youngman, Ltd.

89 Trailers
Remorques
Anhänger
Remolques
The Angel Truck Co., Ltd.
P. C. & C. K. Chase, Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
Eccles (Birmingham), Ltd.
Geest Industries, Ltd.
G. Hunter (London), Ltd.
Lansing Bagnall, Ltd.
M.G.K. Engineering Co., Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Mercury Truck & Tractor Co., Ltd.
Charles Pitt (Barton Stacey), Ltd.
Rubery Owen & Co., Ltd.
Salisbury Precision Engineering, Ltd.
E. Stephens & Son, Ltd.
Superbuilt Products, Ltd.
Wessex Industries (Poole), Ltd.
Willmot Trucks, Ltd.
The Yale & Towne Manufacturing Co.
W. C. Youngman, Ltd.

90 Transporters
Transporteurs
Transportwagen
Transportadores en general
The Angel Truck Co., Ltd.
Autoset (Production), Ltd.
Babcock & Wilcox, Ltd.
British Ropeway Engineering Co., Ltd.
R. H. Corbett & Co., Ltd.
Douglas Equipment, Ltd.
Drag Scraper & Conveyor Co., Ltd.
Eccles (Birmingham), Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Matling, Ltd.
Mitchell Engineering Co., Ltd.
Herbert Morris, Ltd.
Rendale Conveyors, Ltd.
Scottish Mechanical Light Industries, Ltd.
E. Stephens & Son, Ltd.
Stewart Gill & Co., Ltd.
Strachan & Henshaw, Ltd.
Vac-U-Lift (Great Britain), Ltd.
Winget, Ltd.

91 Trucks, Crane (Mobile)
Chariots à grue (mobiles)
Krankarren mit Kraftantrieb
Grúas de carreton (móviles)
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Douglas Equipment, Ltd.
G. Hunter (London), Ltd.
Leverton & Co., Ltd.
M.G.K. Engineering Co., Ltd.
Fred Myers, Ltd.
R. H. Neal & Co., Ltd.
Tunny Cranes, Ltd.
The Yale & Towne Manufacturing Co.

92 Trucks, Fork Lift (Petrol/Diesel/Electric)
Chariots élévateurs à fourche (Essence/Diesel/electriques)
Karren, Gabelstapler (mit Benzin-, Diesel- oder Elektroantrieb)
Carretones elevadores a horquilla (gasolina/diesel/eléctricos)
The Angel Truck Co., Ltd.
E. Boydell & Co., Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Coventry Climax Engines, Ltd.
Diac, Ltd.
Didsbury Engineering Co., Ltd.
Gardiner's Conveyors, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Jewsbury's Mechanical Handling, Ltd.
Lancers Machinery, Ltd.
Lansing Bagnall, Ltd.
Leverton & Co., Ltd.
Lodematic, Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Matbro, Ltd.
Materials Handling Equipment (Gt. Britain), Ltd.
Matling, Ltd.
Montgomerie Reid Engineering Co., Ltd.
Fred Myers, Ltd.
Omic, Ltd.
Powell & Co.
Powell Duffryn Engineering Co., Ltd.
Ransomes & Rapier, Ltd.
Rolatruc, Ltd.
Salisbury Precision Engineering, Ltd.
Scottish Mechanical Light Industries, Ltd.
Shelvoke & Drewry, Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.
Wingrove & Rogers, Ltd.
The Yale & Towne Manufacturing Co.

93 Trucks, Hand
Chariots à bras
Handtransportkarren
Carretones a mano
The Angel Truck Co., Ltd.
Autoset (Production), Ltd.
British Metal Crates, Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
Eccles (Birmingham), Ltd.
Geest Industries, Ltd.
Glenaldie Woodworking & Engineering Co., Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Jewsbury's Mechanical Handling, Ltd.
Kimbell Machine Tools, Ltd.
The Lampeter Timber & Trading Co., Ltd.
Lansing Bagnall, Ltd.
W. Langley & Co., Ltd.
Lenson Engineering Co.
Light Alloy Construction, Ltd.
Lodematic, Ltd.
M.G.K. Engineering Co., Ltd.
A. L. Marshall (Carlton), Ltd.
Herbert Morris, Ltd.
F. Piper & Sons, Ltd.
Powell & Co.
Charles Pitt (Barton Stacey), Ltd.
Power Jacks, Ltd.
Rack Engineering, Ltd.
Salisbury Precision Engineering, Ltd.
J. E. Shay, Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
E. Stephens & Son, Ltd.
Superbuilt Products, Ltd.
Tilgate Saw Mills, Ltd.
Tuglift, Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.
White, Child & Beney, Ltd.
Willmot Trucks, Ltd.
The Yale & Towne Manufacturing Co.
W. C. Youngman, Ltd.

94 Truck, Hand (Pedestrian Controlled)
Chariots à bras, à conduite par piéton
Handtransportkarren (vom Begleiter gesteurert)
Carretones a mano (a mando de peatón)
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
R. H. Corbett & Co., Ltd.
Diac, Ltd.
Eccles (Birmingham), Ltd.
Gardiner's Conveyors, Ltd.
Geest Industries, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Jewsbury's Mechanical Handling, Ltd.
W. Langley & Co., Ltd.
Lansing Bagnall, Ltd.
Lodematic, Ltd.

Matling, Ltd.
Powell & Co.
Rolatruc, Ltd.
Salisbury Precision Engineering, Ltd.
Sheepbridge Equipment, Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.
Wingrove & Rogers, Ltd.
The Yale & Towne Manufacturing Co.
W. C. Youngman, Ltd.

95 **Trucks, Industrial (Power)**
Chariots industriels (motorisés)
Kraftbetriebene Flurförderkarren)
Carretones industriales (a motor)
The Angel Truck Co., Ltd.
Brush Electrical Engineering Co., Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
Douglas Equipment, Ltd.
Eccles (Birmingham), Ltd.
Floataire, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Jewsbury's Mechanical Handling, Ltd.
Lansing Bagnall, Ltd.
Leverton & Co., Ltd.
Lodematic, Ltd.
Matling, Ltd.
Mercury Truck & Tractor Co., Ltd.
Montgomerie Reid Engineering Co., Ltd.
Fred Myers, Ltd.
Omic, Ltd.
Powell & Co.
Salisbury Precision Engineering, Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.
Wingrove & Rogers, Ltd.
The Yale & Towne Manufacturing Co.

96 **Trucks, Pallet or Stillage (Hand and/or Power Operated)**
Chariots à palettes ou chantiers (à bras et/ou actionnés par moteur)
Palettenkarren (für den Hand- und Kraftbetrieb)
Carretones a paletas o de caballete (a mano y/o motor)
The Angel Truck Co., Ltd.
Brush Electrical Engineering Co., Ltd.
George Cohen Sons & Co., Ltd.
J. Collis & Sons, Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
Didsbury Engineering Co., Ltd.
Eccles (Birmingham), Ltd.
Floataire, Ltd.
Geest Industries, Ltd.
Grading Machinery, Ltd.
G. Hunter (London), Ltd.
I.T.D., Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Jewsbury's Mechanical Handling, Ltd.
Lansing Bagnall, Ltd.
Leverton & Co., Ltd.
Light Alloy Construction, Ltd.
Lodematic, Ltd.
A. L. Marshall (Carlton), Ltd.
Matling, Ltd.
Fred Myers, Ltd.
Omic, Ltd.
Penfold Fencing & Engineering, Ltd.
F. Piper & Sons, Ltd.
Powell & Co.
Rack Engineering, Ltd.
Rolatruc, Ltd.
Salisbury Precision Engineering, Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
Thos. W. Ward, Ltd.
Wessex Industries (Poole), Ltd.
West Dock Timber Co., Ltd.
Willmot Trucks, Ltd.
Wingrove & Rogers, Ltd.
The Yale & Towne Manufacturing Co.

97 **Trucks, Straddle**
Chariots encadreurs
Klemmgriffkarren
Carretones de operación a horcajadas
The Angel Truck Co., Ltd.
George Cohen Sons & Co., Ltd.
Conveyancer Fork Trucks, Ltd.
Diac, Ltd.
G. Hunter (London), Ltd.
Industrial Machine & Equipment Co. (Brimpex), Ltd.
Jewsbury's Mechanical Handling, Ltd.
Lansing Bagnall, Ltd.
Lodematic, Ltd.
Materials Handling Equipment (Gt. Britain), Ltd.
Matling, Ltd.
Montgomerie Reid Engineering Co., Ltd.
Omic, Ltd.
Powell & Co.
Rolatruc, Ltd.
The Yale & Towne Manufacturing Co.

98 **Valves and Couplings**
Soupapes et accouplements
Ventile und Kupplungen
Vàlvulas y acoplamientos
Associated Electrical Industries, Ltd.
BTR Industries, Ltd.
British Ermeto Corporation, Ltd.
Conveyancer Fork Trucks, Ltd.
Dowty Hydraulic Units, Ltd.
Dowty Seals, Ltd.
Electro-Hydraulics, Ltd.
Epco, Ltd.
Hydraulics and Pneumatics, Ltd.
Albert Mann Engineering Co., Ltd.
Matling, Ltd.
Maxam Power, Ltd.
Mucon Engineering Co., Ltd.
The Plessey Co., Ltd.
Power Jacks, Ltd.
Silvertown Rubber Co., Ltd.
Spenborough Engineering Co., Ltd.
Super Oil Seals and Gaskets, Ltd.
Westinghouse Brake & Signal Co., Ltd.
Hugh Wood & Co., Ltd.

99 **Vibrators**
Appareils à vibrations
Schwingungsrüttler
Vibradores
E. P. Allam & Co., Ltd.
Electromagnets, Ltd.
The English Electric Co., Ltd.
Locker Industries, Ltd.
Rendale Conveyors, Ltd.
Rownsons (Conveyors), Ldt.
Russell Constructions, Ltd.
Sheepbridge Equipment, Ltd.
Thos. W. Ward, Ltd.
Winget, Ltd.

100 **Wagon Movers**
Tracteurs pour wagons
Wagenrangiermaschinen
Màquinas para el desplazamiento de vagones
The Angel Truck Co., Ltd.
E. Boydell & Co., Ltd.
Jewsbury's Mechanical Handling, Ltd.
Mitchell Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Ross Engineers, Ltd.
Spencer (Melksham), Ltd.
E. G. Steele & Co., Ltd.
Strachan & Henshaw, Ltd.

101 **Wagon Tipplers**
Culbuteurs de wagons
Füllwagen
Volteadoras de vagones
Babcock & Wilcox, Ltd.
Bennis Combustion, Ltd.
Mitchell Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Sheepbridge Equipment, Ltd.
Spencer (Melksham), Ltd.
Strachan & Henshaw, Ltd.

102 **Weighing Equipment**
Matériel de pesage
Wiegegeräte
Equipos de pesar
Saml. Denison & Son, Ltd.
Locker Industries, Ltd.
Merrick Scale Manufacturing Co., Ltd.
Mucon Engineering Co., Ltd.
Murphy Radio, Ltd.
S. Parsons & Co., Ltd.
Richardson Scale Co., Ltd.
Simon Handling Engineers, Ltd.
Richard Sutcliffe, Ltd.
Webb Conveyors & Automation, Ltd.

103 **Wheels**
Roues
Räder
Ruedas
The Angel Truck Co., Ltd.
Autoset (Production), Ltd.
Compressed Rubber Products, Ltd.
Eccles (Birmingham), Ltd.
Flexello Castors & Wheels, Ltd.
F. Piper & Sons, Ltd.
Rubber By-Products (Warwickshire), Ltd.
Rubery Owen & Co., Ltd.
Sheepbridge Equipment, Ltd.
H. C. Slingsby, Ltd.
Willmot Trucks, Ltd.

104 **Winches (Petrol, Diesel, Electric)**
Treuils (Essence/Diesel/électriques)
Winden (mit Benzin-, Diesel- oder Elektroantrieb)
Cabrestantes (gasolina/Diesel/eléctricos)
British Hoist & Crane Co., Ltd.
Butters Bros. & Co., Ltd.
George Cohen Sons & Co., Ltd.
Drag Scraper & Conveyor Co., Ltd.
Felco Hoists, Ltd.
G. Hunter (London), Ltd.
Hydraulics and Pneumatics, Ltd.
Massey-Ferguson (United Kingdom), Ltd.
Matterson, Ltd.
Mitchell Engineering Co., Ltd.
Rendale Conveyors, Ltd.
Strachan & Henshaw, Ltd.
Richard Sutcliffe, Ltd.

RÉPERTOIRE-LÉGENDE

Accessoires pour l'allumage **50**
Accumulateurs/Batteries **1**
Appareils de levage (motorisés) **47**
Appareils de levage (à main) **46**
Appareils à vibrations **99**
Appareils vide-coffres **11**
Ascenseurs **54**

Bennes preneuses **45**
Boîtes et caisses **13**
Bulldozers et angledozers **15**

Chaînes **19**
Chantiers (pour fûts) **83**
Chargeurs de camions **57**
Chargeurs de palettes **62**
Chariots à bras **93**
Chariots à bras, à conduite par piéton **94**
Chariots élévateurs à fourche (Essence/Diesel/électriques) **92**
Chariots encadreurs **97**
Chariots à grue (mobiles) **91**
Chariots industriels (motorisés) **95**
Chariots à palettes ou chantiers (à bras et/ou actionnés par moteur) **96**
Cordes et câbles (tous genres) **71**
Courroies (en tous genres) **9**
Cribles et tamis **73**
Crics et vérins (à levier et/ou à poulie) **52**
Culbuteurs de wagons **101**

Déchargeurs à bascule **36**
Dispositifs d'étanchéité **74**
Dispositifs de fixation **42**

Echelles **53**
Ecrous indesserrables **55**
Elévateurs **40**
Elingues **78**
Empileurs **80**
Engrenages **44**
Ensacheurs **5**
Equipement de chaleur rayonnante **70**
Equipement hydraulique **48**
Equipement pour charge des batteries **7**
Equipement pour le dessin et l'illustration techniques **35**
Equipement de prise de courant **32**
Equipement de régulation et commande électronique **38**

Facilités de banque et d'assurance **6**
Fournitures pour réparations de transporteurs à courroie **24**
Funiculaires et téléfériques **17**

Godets de transporteur **25**
Groupes de commande de transporteurs **26**
Grues (d'atelier) **31**
Grues (à flèche) **28**
Grues (mobiles) **29**
Grues (à pont roulant) **30**

Indicateurs de charge de sécurité **72**

Locomotives (pour les houillères) **56**
Lubrifiants **58**

Machines de bureau **60**
Machines à cercler au feuillard **82**
Machines d'emballage des bouteilles **12**
Manutention de bennes de houillère **22**
Matériel anti-poussières **36a**
Matériel de conservation et d'emmagasinage **84**
Matériel d'emballage **60a**
Matériel de graissage **59**
Matériel de pesage **102**
Matériel de manutention et d'alimentation pour rouleaux (fil, etc.) **21**
Matériel pour manutention des cendres **4**
Matériel de manutention du charbon **20**
Matériel de manutention pneumatique **64**
Matériel de manutention en vrac **14**
Matériel de transmission de puissance (Y compris engrenages et transmissions par fluides) **66**
Mécanismes de commande **23**
Moteurs (Diesel/essence) **41**
Moteurs électriques **37**
Moufles (à bras) **67**
Moufles (motorisés) **68**

Palettes **61**
Pelles (hydrauliques et mécaniques) **76**
Pièces métalliques refoulées **80a**
Pompes **69**

Rampe réglable pour docks **2**
Remorques **89**
Roues **103**
Roues et poulies intermédiaires **49**
Roulements **8**
Roulettes **18**

Scrapers à câble **34**
Services **75**
Skips **77**
Soupapes et accouplements **98**
Soutes **16**
Systèmes de tubes pneumatiques **65**

Telphérages **86**
Tracteurs (Tous types—Essence/Diesel/électriques) **88**
Tracteurs pour wagons **100**
Transporteurs **90**
Transporteurs (tous types) **27**
Transporteurs aériens à câble **3**
Transporteurs bilatéraux **85**
Visite (inspection, vérification) **51**
Treuils (Essence/Diesel/électriques) **104**
Tubes en acier **81**

SCHLÜSSEL-WÖRTERVERZEICHNIS

Abschirmungen **73**
Akkumulatoren/Batterien **1**
Anhänger **89**
Antriebsköpfe **26**
Aschenförderanlagen **4**
Aufzüge **54**
Aufzüge (für den Handbetrieb) **46**
Aufzüge (mit Motorantrieb) **47**
Auslegerkräne **28**

Bandstahlbinder **82**
Bank- und Versicherungsagenturen **6**
Batterieladegeräte **7**
Befestigungsvorrichtungen **42**
Behälterentlader **11**
Belastungsanzeiger **72**
Buldozer und Seitenräumer **15**
Bunker **16**
Büromaschinen **60**

Dichtungen **74**
Dienstleistungen **75**
Drahtseilbahnen **3**
Druckluftbezeuge Druk- und Saugluftförderer **64**
Elektrohängebahnen **86**
Elektromotoren **37**
Elektronische Steuergeräte **38**

Fahrkräne **29**
Flaschenverpackungsmaschinen **12**
Flaschenzüge (für den Handbetrieb) **67**
Flaschenzüge (mit Kraftantrieb) **68**
Förderer (aller Art) **27**
Förderkübel **25**
Förderriemen (aller Art) **9**
Förderriemen-Reparaturmaterial **24**
Füllwagen **101**

Getriebe **44**
Griefer **45**

Handtransportkarren **93**
Handtransportkarren (vom Begleiter gesteuert) **94**
Hebeböcke **52**
Hebewerke **40**
Heizkörper **70**
Hydraulische Geräte **48**

Karren, Gabelstapler (mit Benzin-, Diesel- oder Elektroantrieb) **92**
Ketten **19**
Kippaufzüge **77**
Kisten und Kästen **13**
Klemmgriffkarren **97**
Klemmuttern **45**
Kohlenförderanlagen **20**
Kontrolle **51**
Kohlenförder- und Schüttanlagen **21**
Kraftbetriebene Flurförderkarren **95**
Kraftübertragungsmittel (einschliesslich Zahnrad- und Flüssigkeitsgetriebe) **66**
Krankarren mit Kraftantrieb **91**

Lager **84**
Lagerausrüstungen **84**
Laufkräne **30**
Laufrollen **18**
Lietern **53**
Löffelbagger (hydraulische und mechanische) **76**
Lokomotiven (für den Zechenbetrieb) **56**

Motoren (Diesel/-, Benzin-) **41**

Palettenkarren (für den Hand- und Kraftbetrieb) **96**
Palletlader **62**
Pallets **61**
Pumpen **69**

Räder **103**

Sackfüller **5**
Saugrohre **65**
Schlepper (aller Art-mit Benzin-, Diesel- oder Elektroantrieb) **88**
Schleppschrapper **34**
Schlingen **78**
Schmiergeräte **59**
Schmiermittel **58**
Schüttgutförderer **14**
Schüttwagen **36**
Schwingungsrüttler **99**
Seile und Kabel (aller Art) **71**
Seillaufbahnen **17**
Stahlrohre **81**
Stahl-Strangpresslinge **80a**
Stapler **80**
Staubkontrollausrüstung **36a**

Steuergeräte **23**
Stromabnehmer **32**

Tiefladewagen **85**
Transportbehälter **83**
Transportwagen **90**

Umlenkrollen, Spannrollen **49**

Ventile und Kupplungen **98**
Verpackungsbedarf **60a**
Verstellbare Hafen-Laderampe **2**

Wagenlader **57**
Wagenrangiermaschinen **100**
Werkstattkräne **31**
Wiegeräte **102**
Winden (mit Benzin-, Diesel- oder Elektroantrieb) **104**

Zechen-Förderwagen **22**
Zeichenmaschinen **35**
Zündzubehör **50**

GLOSARIO CLAVE
Accesorios de ignición **50**
Acumuladores/Baterías **1**
Aparejos elevadores (accionados a mano) **46**
Aparejos elevadores (accionados a motor) **47**
Aparatos de mando **23**
Apiladoras **80**
Arcones y tanques de almacenaje **16**
Ascensores **54**

Bombas **69**
Bulldozers y empujadoras en àngulo **15**

Caballetes y estantes **83**
Cabezales motores para transportadores **26**
Cablevías tranvías aéros **17**
Cabrestantes (gasolina/Diesel/ eléctricos) **104**
Cadenas **19**
Cajas y cajones **13**
Cargadoras de camiones **57**
Cargadoras de paletas **62**
Carretones elevadores a horquilla (gasolina/Diesel/eléctricos) **92**
Carretones industriales (a motor) **95**
Carretones a mano **93**
Carretones a mano (a mando de peatón) **94**
Carretones a paletas o de caballete (a mano y/o a motor) **96**
Carretones de operación a horcajadas **97**
Cierres estancos **74**
Correas (todos tipos) **9**
Cribasytamices **73**
Cucharas de agarre **45**
Cuerdas y cables (de todo género) **71**

Descargadoras de depósitos **11**
Diseño e ilustración técnica **35**
Dispositivos para fijación **42**

Elevadores **40**
Engranajes **44**
Ensacadoras **5**
Equipos de calor radiante **70**
Equipos de control electrónico **38**
Equipos de control de polvos **36a**
Equipos hidráulicos **48**
Equipos de lubricación **59**
Equipos para almacenaje **84**
Equipos para carga de baterías **7**
Equipos para embalaje **60a**
Equipos para el manipuleo y alimentación de rollos **21**
Equipos para el manipuleo de carbón **20**
Equipos para el manipuleo en masa **14**
Equipos de pesar **102**
Equipos de toma de corriente **32**
Equipos de transmisión de fuerza (inclusive engranajes y transmisiones a fluido) **66**
Escaleras **53**
Eslingas **78**
Extrusiones de acero **80a**

Gatos (alzadores o de poleas) **52**
Grúas de carretón (móviles) **91**
Grúas (móviles) **29**
Grúas (de pluma) **28**
Grúas (de puente) **30**
Grúas (de taller) **31**

Indicadores de carga de seguridad **72**
Inspecciones **51**
Instalaciones para manipuleo de cajones en minas de carbón **22**
Instalaciones para el manipuleo de cenizas **4**
Instalaciones de manipuleo neumático **64**

Locomotoras (para uso en minas de carbón) **56**
Lubricantes **58**

Máquinas embaladoras de Botellas **12**
Máquinas para el desplazamiento de vagones **100**
Máquinas para oficinas **60**
Máquinas de precintar con flejes **82**
Materiales para reparación de transportadores a correa **24**
Montacargas de cajón **77**
Motores (Diesel/gasolina) **41**
Motores eléctricos **37**

Palas y cangilones de transportador **25**
Palas (hidráulicas y mecánicas) **76**
Paletas **61**
Poleas múltiples (accionadas a mano) **67**
Poleas múltiples (accionadas a motor) **68**

Rampa graduable para muelles **2**
Remolques **89**
Rodamientos **8**
Ruedas **103**
Ruedas de pivote **18**
Ruedas y poleas intermediarias **49**

Servicios **75**
Servicios Bancarios y de Seguros **6**

Teleféricos **86**
Traíllas o palas a cable de arrastre **34**
Tractores (todos tipos—gasolina/Diesel/ eléctricos) **88**
Transportadores por cables aéreos **3**
Transportadores a horcajadas **85**
Transportadores en general **90**
Transportadores (todos tipos) **27**
Tubos de acero **81**
Tubos neumáticos **65**
Tuercas de sujeción **55**

Válvulas y acoplamientos **98**
Vibradores **99**
Volteadoras **36**
Volteadoras de vagones **101**

August

Among the feature articles this issue will contain the following:

Iron Ore Preparation
Materials Handling and Automation in the Foundry
Mechanized Bottling Plant
Conveyor Belting with Corrugated Sides
Handling Milled Peat at Power Stations Part II
Sugar at Ten Hundredweight a Minute
and Regular Features

NEWS OF PERSONALITIES

D. C. Haney

H. D. Frymire

David C. Haney, who has been director of sales for International Harvester Company of Great Britain, Ltd., since January 1st, 1954, is now appointed assistant managing director. In the period of six years in which he acted as director of sales, the company's sales volume has more than trebled and in 1959 exceeded £23,500,000.

At the same time, the company has welcomed to the board **H. D. Frymire** who, since September, 1957, has been manager of domestic sales and now becomes director of sales.

Dewrance & Co., Ltd., announce that **J. W. Plowman** has resigned his directorship due to health reasons and **B. S. Bass,** previously sales manager, has been appointed to the board as sales director. The following appointments have also been made: **A. Brown,** sales manager (home); **A. C. Jones,** sales manager (export); **C. G. Seeds,** sales manager (controls division).

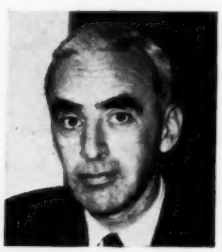
The Leverton Group of Companies, Caterpillar dealers operating from Spalding, Leeds, Wigan, Newcastle and Rotherham, announce the appointment of **Laurie F. Everard** as managing director. Other recent appointments include the promotion of **Fred Parnham** to the position of general service manager for the group of companies. His previous duties as service manager, Leverton of Leeds, Ltd., will be carried out by the appointment of **Harry Bramham** in this capacity.

Gerry Mousley, late of West Riding County Council, Highways and Bridges Department, has now been appointed civil engineering consultant for the Leverton group of Companies.

The election of **M. L. Jofeh, O.B.E., A.M.I.E.E.,** manager industrial division, as an additional director of Sperry Gyroscope Co., Ltd., is announced.

Mr. Jofeh joined Sperry in 1947 as an equipment engineer, subsequently heading the engineering unit at the company's Stonehouse (Glos.) factory for a number of years. In February, 1954, he returned to Brentford to take up the position of deputy chief engineer and later chief engineer of the company with responsibility for the design of all new equipment. His appointment as manager of the newly formed industrial division was announced in January, 1959, when the company disclosed its reorganization plans covering the extension of its activities into the field of industrial control systems and instrumentation.

M. L. Jofeh



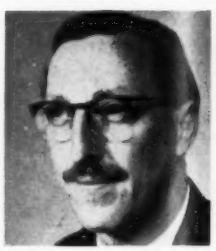
W. J. Heywood

F. J. Pearson

J. Lunn

F. J. Pearson, micro switch branch sales manager of Honeywell Controls, Ltd., Birmingham branch, has been given the additional responsibility of developing sales, service and customer engineering in the machine tool industry. **J. Lunn** has transferred from the company's Manchester branch to head office at Greenford to develop sales and services of new micro switch products. His immediate attention will be largely devoted to meeting the needs of the computor, business machine, and control panel industries.

Bray Construction Equipment Co., have appointed **Maurice S. Hall** to the position of assistant home sales manager. Mr. Hall, who joined the company in 1957 as a senior area representative, was previously with Dowty Hydraulic Units, where he was in charge of contracts and sales. For seven years before this appointment he was an office manager with George Wimpey, Ltd.



M. S. Hall

W. J. Heywood, chairman and managing director of S. H. Heywood & Co., Ltd., has, owing to the death of his cousin S. W. Heywood taken over the direction of the Reddish Crane Works in addition to the Manchester Electrical Contracting Works.

The directors have appointed **W. Howe** and **A. L. Hawes,** both of whom have been employed with the company for 60 years, to be general managers of the Manchester and Reddish Works respectively.

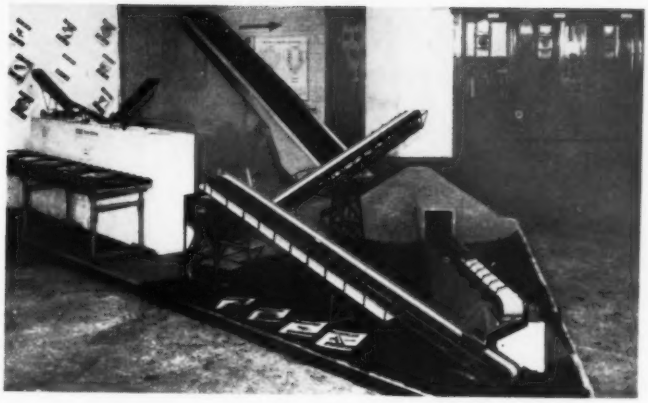
OBITUARIES

The death has occurred of **W. M. Grainger,** director and secretary of Walter Somers, Ltd., Mr. Grainger joined the company on May 1st, 1946, as assistant secretary on his return from H.M. Forces. Several years later he was made secretary and in 1959 was appointed to the board of directors. Mr. Grainger was also a director of the subsidiary company, Walter Somers (Materials Handling), Ltd.

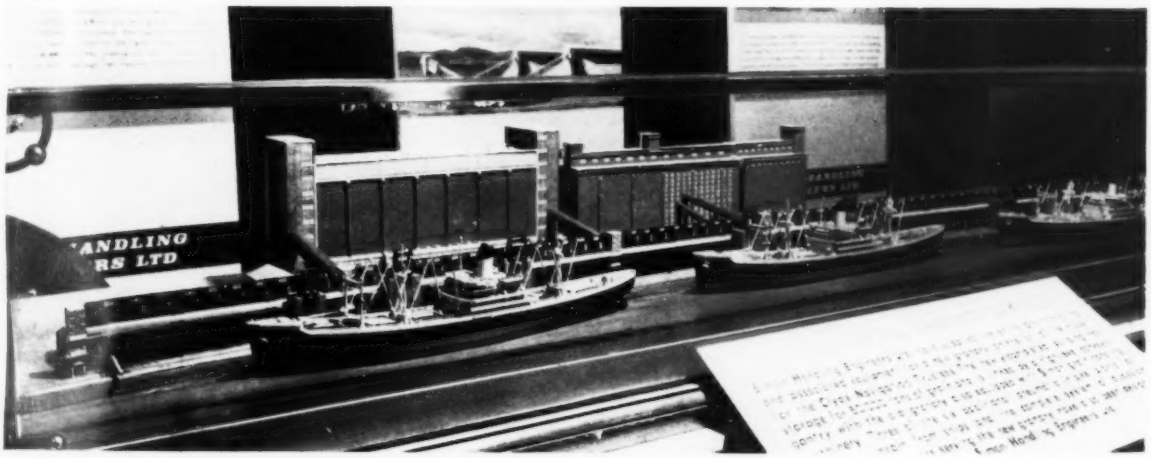
The death is announced of **James Hill,** who was for many years well known for his work in the design of cranes and lifting gear. He spent over 20 years with the Vaughan Crane Co., Ltd., and was a director from 1937-48.

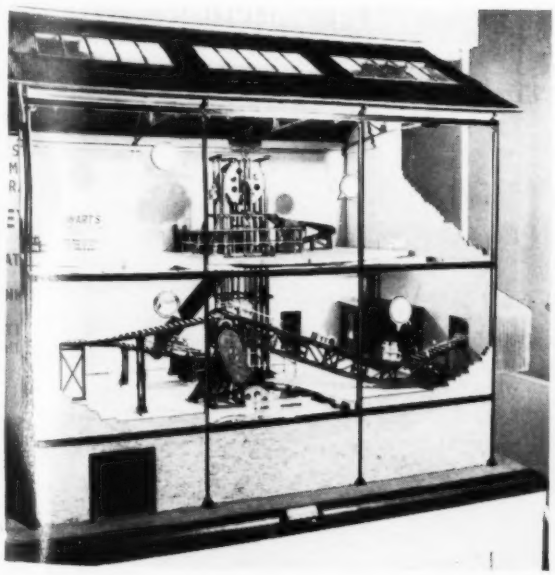
Models on Show

In our last issue, June, we published three pages of pictures showing models of plant and equipment which were seen on the stands of exhibitors at the 7th Mechanical Handling Exhibition, organized by this journal. In view of the large number of excellent models shown, we are now publishing a further selection of pictures.



A large model of a gravel conveying system to stockpile. Universal Conveyor Co., Ltd.

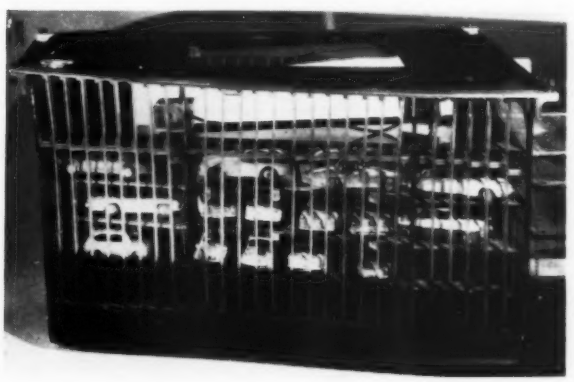


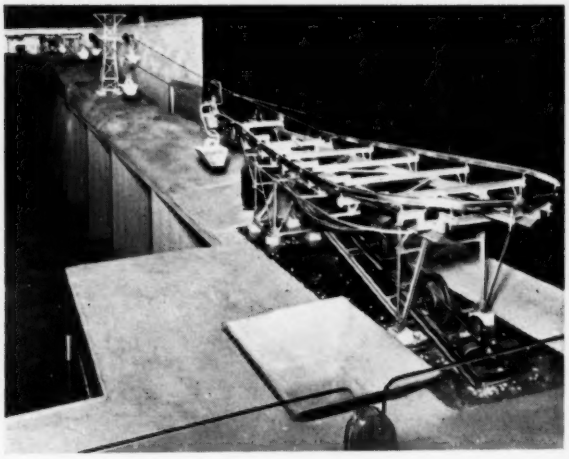


(Above) Model of the new Meadowside Granary, Glasgow. Simon Handling Engineers, Ltd., supplied the entire grain handling and associated equipment for a new granary (on the left of the model) for the Clyde Navigation Trustees

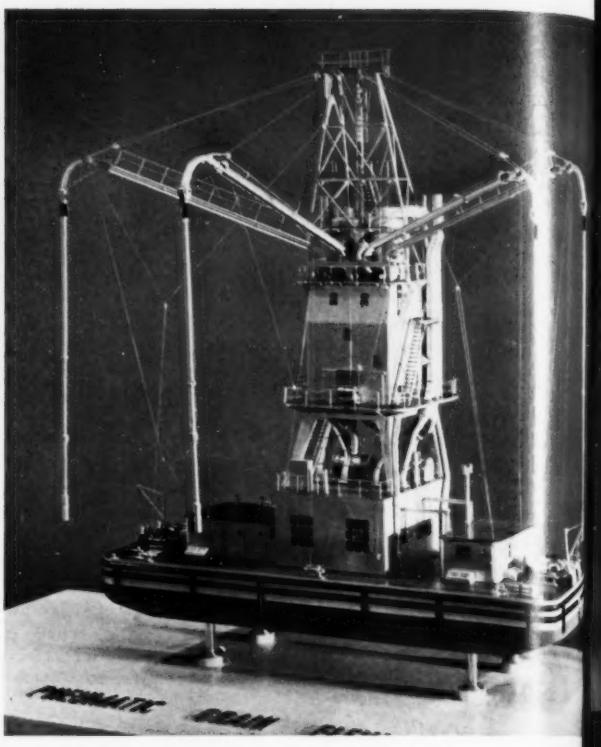
(Left) Ewarts Mechanical Handling Plant, showing in model form a swing tray elevator, gravity roller conveyor, automatic spacer and slat conveyors

(Below) Model of a 'Carflow' installation in a cargo vessel. Fisher & Ludlow, Ltd.

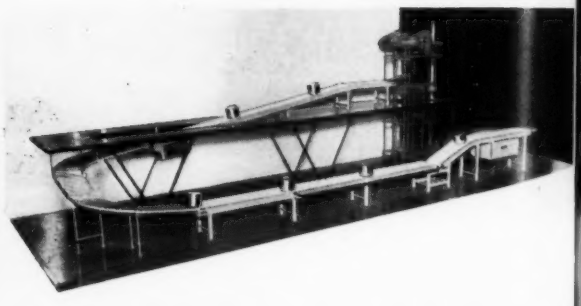




(Above) Working model of an overhead conveying system. Ropeways, Ltd.



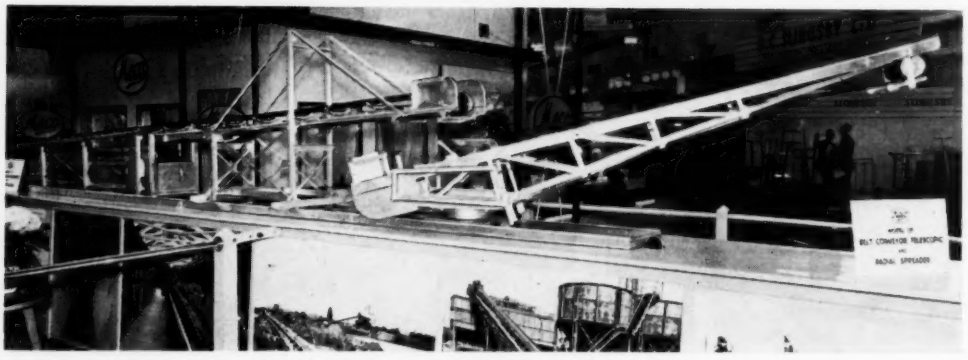
(Right) Detailed model of a pneumatic grain elevator shown by Holland Cranes

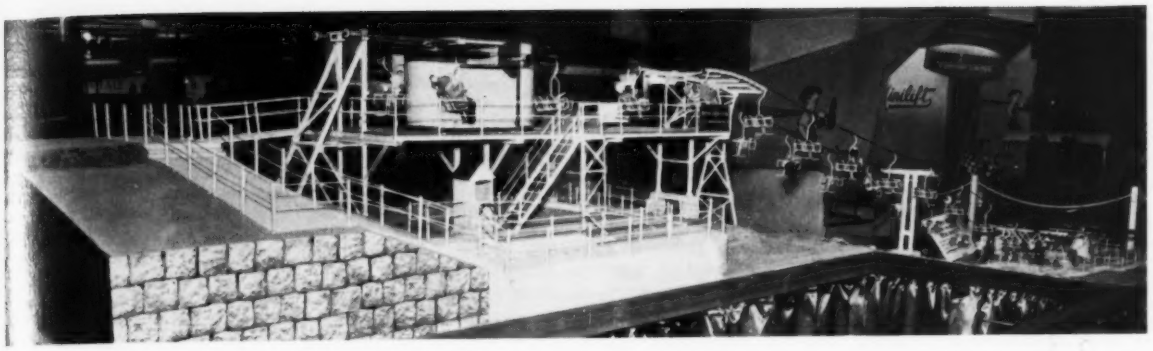


(Above) Working model demonstrating flat belt and roller conveyor and elevator operation. Universal Conveyor Co., Ltd.

(Left) An amusing full-scale demonstration making use of air control equipment by Lang Pneumatic, Ltd.

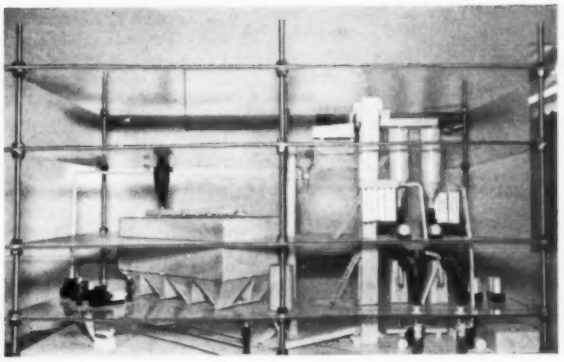
(Below) Telescopic belt conveyor with radial spreader. The Mining Engineering Co.

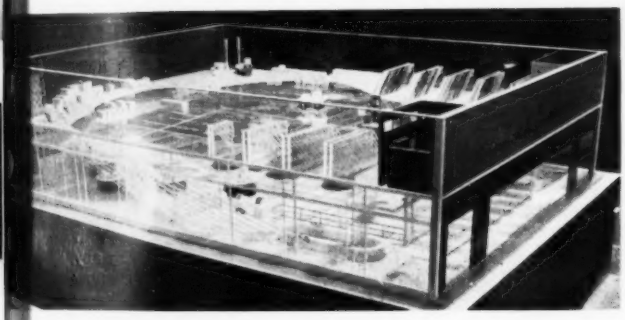




(Above) Large working model of a chairlift by British Ropeway Engineering Co., Ltd.

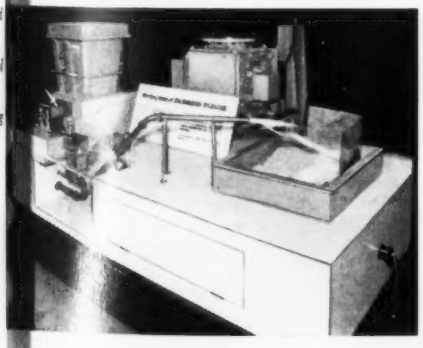
(Right) Model of a provender mill manufactured and designed by F. E. Callow (Engineers), Ltd.





(Left) Block model showing the layout for an automatic supermarket. John Brown Automation

(Below) Working model of the Rapier W1400 walking dragline on the stand of Associated Electrical Industries, Ltd.



(Above) Working model of the Babcock 'Projector'. Babcock & Wilcox, Ltd.

REVIEW OF NEW EQUIPMENT

A recent addition to the range of Rapid Magnetic tramp iron diverters for heavy burden depths

TRAMP IRON DIVERTERS

The range of tramp iron diverters manufactured by Rapid Magnetic Limited, Lombard Street, Birmingham, 12, has now been extended to cover burdens beyond the capacity of conventional pulley and pulley-type separators. A typical unit for the recovery of iron-bearing slag is 42 in in dia, 60 in wide and weighs approximately 6¼ tons. High-temperature Class B insulation is used throughout to cater for the treatment of hot slag, while the drum cover is of substantial thickness, of stainless steel and provided with expendable outer covers.

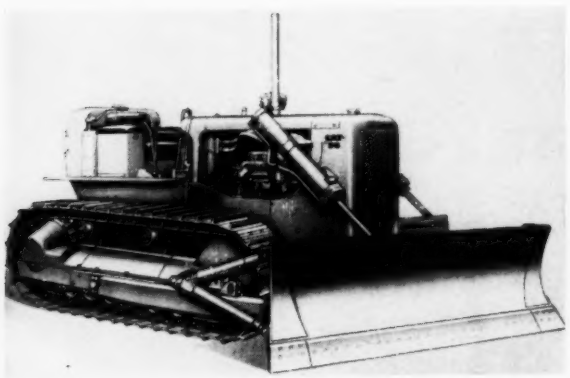
NEW CATERPILLAR D6 TRACTOR

To give greater operating efficiency, major improvements have been incorporated in a new D6 Series B tractor announced by the Caterpillar Tractor Co., Peoria, Illinois, U.S.A. These include a new engine of 93 h.p. at 1,600 r.p.m., giving 25 per cent greater lugging ability, two new hydraulic control units, integrally mounted, tilt cylinder for special applications, optional transmission for jobs calling for greater drawbar pull and a more efficient and comfortable operator's cabin.

Located at the rear of the engine, under the hood, the hydraulic control pump and tank are clear of the radiator face and increase cooling. The hydraulic controls, Nos. 165 and 143, deliver constant power, being driven off the timing gear, and have full-flow fluid filtration. A check valve holds the dozer blade in position when the valve is moved from the 'Hold' to the 'Raise' position. The No. 165 control, though intended primarily for controlling the dozer blade, can, by the addition of an internal valve, control either a tilt cylinder or tractor-mounted ripper. With another external valve a dozer blade, tilt cylinder and ripper can be controlled with the one unit. The No. 143 control can be used for operating the tilt cylinder on cable-controlled dozer blades, or for control of the tool bar and tool bar dozer. The tilt cylinder is foot-controlled, facilitating operation. Centre-mounted control cylinders allow almost twice the dozer blade drop below ground level.

A strengthened radiator guard permits installation of hydraulic or cable dozer blades without requiring a special heavy-duty guard. In the new operator's cabin the gear levers are re-located to reduce hand travel distance and the seat, moved 6 in forward, has wide arm rests and side padding. Footrests are in more natural work positions, and gauges, grouped into a new console-type panel, are more easily read and protected from damage. A new 15-h.p. petrol starting engine with off-track recoil starter is standard. In-seat starting is optional, with a 12-V electrical system, and a 24-V system is optional for a diesel engine. Both engines have new dry-type air cleaners. That on the diesel has two elements, the main one easily removable for air pressure cleaning, and the other giving additional protection if the main one receives undetected damage. A new tapered hood and re-allocated operator's seat improve visibility so that the cutting edge of the right and left ends of the dozer blade are seen. Fuel tank capacity is increased to 54 gal from 40 gal on previous models. The new compact engine improves the machine's balance, stability and ability to be worked with heavy front-mounted equipment, and increased oscillation, through a new equalizer spring arrangement that shifts the centre of gravity uphill, ensures safe working on steep slopes.

In this country Caterpillar tractors are handled by the Caterpillar Tractor Co. Ltd., P.O. Box No. 162, Glasgow.



Many improved features have increased the operating efficiency of the new Caterpillar D6 Series B crawler tractor

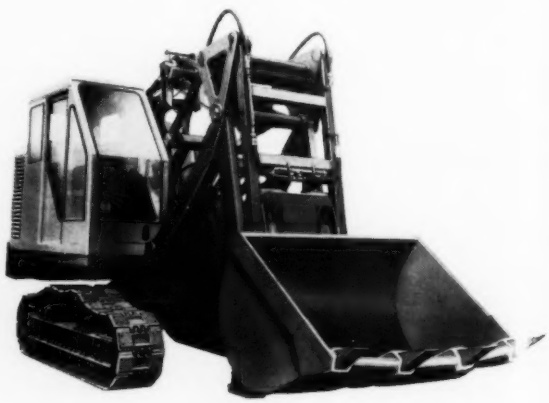
NEW EXCAVATOR AND LOADER

For excavating and loading in quarries and sand and gravel pits the new Hydrascoop, announced by Blaw Knox Ltd., 94 Brompton Road, London, S.W.1, will handle up to 350 cu. yd./hr, using less than 70 h.p. It has been tested for several months, working in granite, limestone, sandstone and heavily compacted soil, and on re-handling work is said to have given outstanding performance. It will speed up loading sand, gravel, coal and coke from stockpiles and many other materials, such as chemicals and fertilizers. For re-handling work the 2 cu-yd. bucket is standard, but larger buckets can be fitted for lighter materials.

Raising and lowering of parallel linkage is by hoisting line; clutch and brake drums are booster-operated and controlled through pedals, giving effortless operation. Bucket thrust and break-out operations are hydraulically operated through finger-light controls, and a digging force of 26·5 tons is exerted at the bucket teeth. The Hydrascoop has a 360 deg swing with 20 ft level clean-up radius, will dig any angle of slope and excavate to 2 ft below ground level. A maximum discharge height of 9 ft 10 in assures ample clearance to load the largest capacity dumpers and wagons.

The parallel linkage action gives long reach and high lift, and maintains bucket

(continued on page 505)



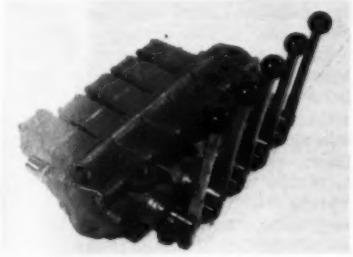
All-round visibility is afforded from the side-mounted operator's cabin of the new Hydrascoop excavator and loader which will handle up to 350 cu. yd./hr

level during lifting, thus preventing any loss of load. The hydraulic system is fully sealed, and constant power to the rams is delivered by the pump driven by a front power take-off from the 6-cyl diesel engine which develops 67 b.h.p. at 1,380 r.p.m. The machine travels easily and quickly, can be rapidly changed over from travel to operation or vice-versa and be transported by a low loader without dismantling as the overall width is well within the limits permitted by road regulations.

MULTI-BANK HYDRAULIC CONTROL VALVE

A new design of multi-bank valve for incorporation in hydraulic systems of mechanical handling equipment permits the use of any number of valves in the bank, either individually or simultaneously, without load drop when controlling cylinders at lower than mains operational pressure. This has been achieved by incorporating a check valve of special design in the valve body and positioning it in the pressure line between the valve spools. Special methods of forming the valve ports ensure that this valve and associated porting are of sufficient capacity to avoid generation of heat under operational conditions.

The manufacturers, Joseph Young and Sons, Ltd., Kay Street, Bolton, Lancs. have made the valve extremely adaptable, and composite banks for any number of controls can be made up from only three basic units easily combined to meet



A five-unit example of the new Young multi-bank hydraulic control valve

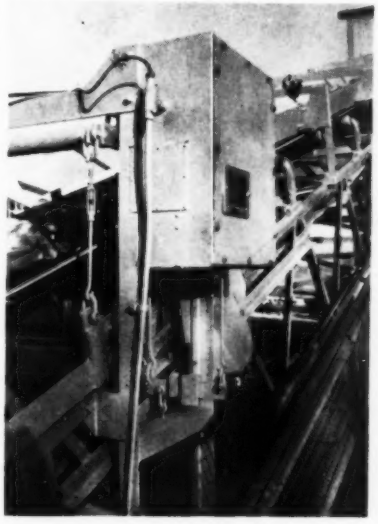
requirements. Hydraulic balance of each valve and careful design of the spool profile give sensitive and accurate control at all lever positions with no load drop.

The valves are available in capacities ranging from 15 to 45 g.p.m. at operating pressures up to 2,000 p.s.i. They can be used to advantage in any hydraulic control system, mobile or stationary, and are suitable, therefore, for all types of mechanical handling equipment, coal mining appliances, earth-moving vehicles and other hydraulically controlled and operated machinery.

CONVEYOR BELT WEIGHING MACHINE

The new SV Weighmaster conveyor belt weighing machine will fit to horizontal or inclined conveyors, having either flat or troughed idlers, and will totalize the weight of material passed. The heart of the machine is a mechanical integrator which continuously multiplies two varying quantities: the every-varying load on the conveyor, often subject to extreme and very rapid fluctuations, and a slightly varying belt speed. The speed of any conveyor, usually considered as constant in reality varies slightly with the load, and in weighing, unless these conditions are taken into consideration, any final results will be erroneous.

The Weightometer can be supplied to suit any conveyor capacity and belt speed. All types of instrumentation are available,



A conveyor fitted with one of the new Merrick SV Weightometer weighing machines

both electric and pneumatic. The weight recorder, which shows the weight of material handled, can be at a remote position if required. Advantages of the machine are that it can be fitted to existing conveyors with a minimum of modification, simplicity of design and low headroom requirements. Accuracy is plus or minus ½ per cent of true weight passed when the conveyor is operating at full-load conditions.

The SV Weightometer is handled in this country by the Merrick Scale Manufacturing Co., Ltd., Albert Street, Bulwell, Nottingham, which is associated with the Merrick Scale Manufacturing Co., Passaic, New Jersey, U.S.A., who have produced this type of equipment since 1911.

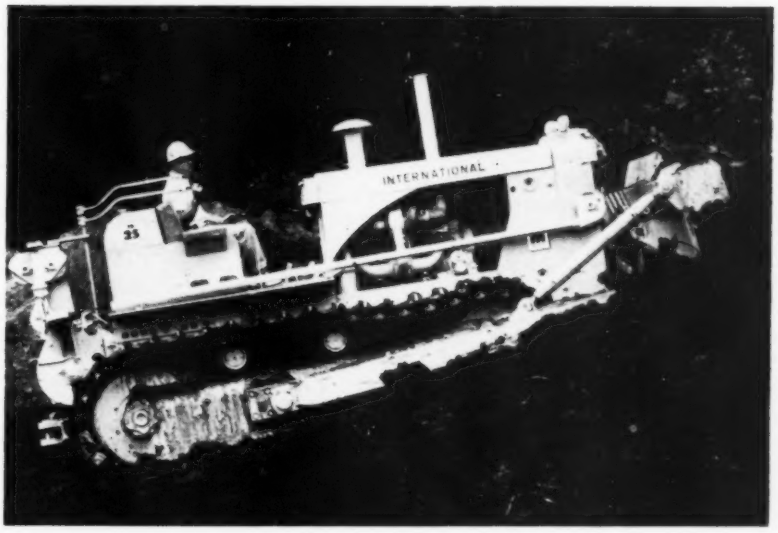
GIANT INTERNATIONAL CRAWLER TRACTOR

The most powerful International crawler tractor ever produced by the International Harvester Co., is now available for export. It is designed for major earth-moving, logging, pipe line laying and mining operations. The new TD-25 diesel-engined machine is available in either a torque converter or gear drive version. Both models are powered by the DT-817 turbo-charged 6-cyl, direct-starting engine developing 230 b.h.p. at 1,500 r.p.m. This engine is also used in other large International earth-movers, such as the Payscraper, Paywagon and Payhauler.

Four speeds forward and reverse are offered by the torque converter model, which has a drawbar pull up to 70,000 lb at 0·75 m.p.h. Operating weight is 46,000 lb. With gear drive and operating weight of 45,500 lb the drawbar pull in first gear at rated governed speed is 46,700 lb and there are eight forward and reverse speeds.

The heavier reinforced track frames, of 'box within a box' construction, are said to be the strongest in the industry, and the large-reservoir track rollers, Dura-rollers, have exclusive cartridge-type seals. They combine heavy-duty bushing, drilled pressure-relief passages and metal-to-metal faces seals, requiring lubrication only at 1,000 hr intervals. Three-point suspension lengthens the life of track rollers, track chains and bushings. A

An International TD-25 diesel-engined crawler tractor equipped with a Model 260 cable-control unit and Model D-3 front cable-controlled bulldozer blade



new heavy-duty radiator guard is standard equipment.

The International Harvester Planet Power system permits turning with controlled power on both tracks with fingertip steering. This eliminates power-wasting dead-track drag in turns, permitting the fully-loaded tractor to turn smoothly under positive control whether working upgrade, downgrade or on the level. Planet-Power also provides instant speed-range shifting and one-hand hydraulic braking. The all-steel welded one-piece rear main frames is stress-relieved and then line bored, ensuring perfect alignment of all shafts, bearings and working gears. The front engine support is built up from four pieces of steel plate, box sectioned and seam welded throughout.

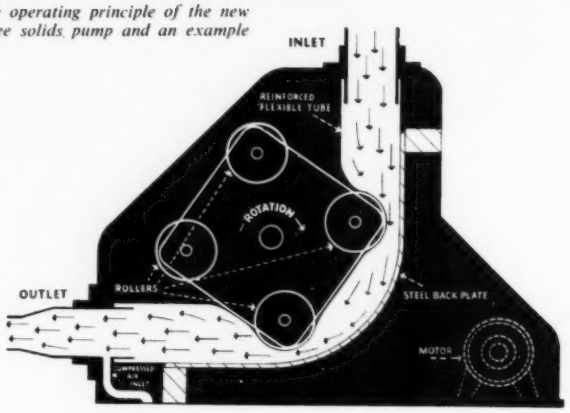
The cooling system comprises a 24-gal radiator, with 11·5 sq. ft. frontal area mounted on four rubber pads, gear-driven fan and water pump and oil cooler. Additional cooling is accomplished by spraying the underside of the pistons with 1½ gal of oil/min when the engine is running. A separate heat exchanger stabilizes torque converter temperature. A 14-in air cleaner ensures that 99·9 per cent clean air reaches the engine. Fuel capacity is 135 gal. Warm air is directed away from the operator's compartment by a three-piece hood with heat deflectors, and seat and arm rests are raised to improve visibility. With standard 24-in track shoes, the crawler is 104 in wide, its overall length 196⅞ in and area of ground contact 5,652 sq. in. A complete range of hydraulic or cable-controlled blades and pusher plates is available.

The tractor is handled by the International Harvester Company of Great Britain, Ltd., Harvester House, 259 City Road, London, E.C.1.

PUMP FOR POWDERED MATERIAL

Known as the Squeegee, a new solids pump, designed for the short-transfer conveying of powders, has been announced by Henry Simon, Ltd., Cheadle Heath, Stockport. It will convey practically any type of powdered material that can be fluidized by air. Conveying rates, depending on the material handled, range up to 8,000 lb/hr. Vertical lifts up to 70 ft, with total conveying lengths of 200 ft, are being achieved under normal working conditions.

The pump consists of an open flexible tube, a rotor with four equidistant rollers and a compressed air inlet. The rotor progressively squeezes the material through the flexible tube, compressing and releasing the tube in turn, thrusting the material through in a continuous stream like toothpaste squeezed from a tube. Only then is air brought into contact with the stock; unable to leak back through the pump because of the pressure of the rollers, it is used solely for conveying the stock. Only 10 per cent of the air used in a conventional system is needed. About 15 to 20 cu. ft. a min is normally adequate and no expensive dust collection apparatus is necessary, a simple filter sock being sufficient, In the event of the stock running out, the pump can run dry without sustaining any damage.

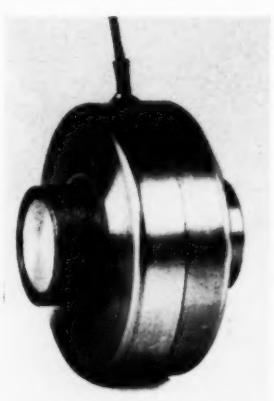


Illustrating the operating principle of the new Simon Squeegee solids pump and an example in use

The Squeegee pump is a compact unit, measuring only 17 in wide, 44 in long and 37 in high. It is made in two sizes, 3 and 2 in, these figures referring to the diameters of the flexible tubes. 1-h.p.motor is required. The pump is available with or without a compressor and is supplied with the requisite length of conveying pipe. The flexible tube is a consumable spare and can be replaced in minutes. Its working life can be as much as 1,000 hrs.

MAGNETIC INSTRUMENT CLUTCHES

For transmitting torques from 4·2 oz-in to 420 oz-in at speeds up to 20,000 r.p.m. the stationary-field magnetic instrument clutches manufactured by Crofts (Engineers), Ltd., Thornbury, Bradford, 3, are at present made in a standard range of five sizes. They can be used as clutch-couplings, clutch-brakes and duplex clutches, and have wide applications in the instrument and light engineering fields. There is also a range of positive engagement clutches, having the same physical dimensions as the standard instrument types and capable of transmitting torques from 14 oz-in to 1,400 oz-in at speeds up to 20,000 r.p.m. These can be used with advantage for indicator drives and for any applications where a non-slip drive is of importance. All these clutches feature rapid response characteristics which emphasize their capability for high frequency instrumentation.



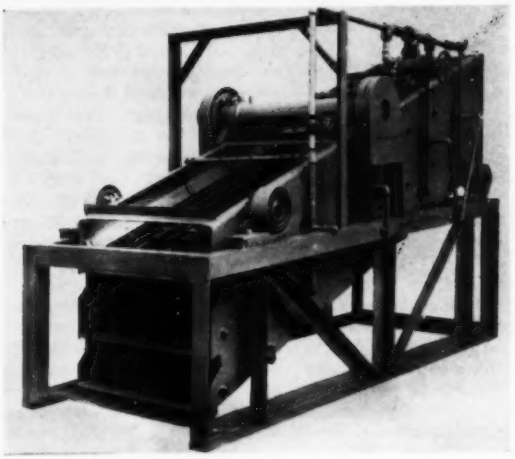
One of the five sizes of Crofts stationary-field magnetic instrument clutches

BRITISH OVERSTROM VIBRATING SCREENS

Exclusive features are included in the design of the successful American Overstrom screens now to be produced by Armstrong Whitworth (Metal Industries), Ltd., Close Works, Gateshead, 8, who have world manufacturing and selling rights with the exception of the Americas and New Zealand. The screens are suitable for installation in mines, quarries, chemical works, granaries, oilfields and potteries, are built for wet or dry, light, medium and heavy service in seven sizes ranging from 3 ft × 18 in to 16 ft × 6 in and are equipped with one, two or three decks. All can be fitted with partial or complete dustproof enclosures, water spray equipment and heating units for the finer mesh decks dealing with damp, sticky materials.

Vibration is set up by unbalanced flywheels at the ends of a plain shaft in the vibration unit fixed rigidly to the

(*Continued on page* 507)



Inclined springs on the frame are a feature of the Armstrong Whitworth Overstrom vibrating screen. This triple-deck example is fitted with water spray equipment on all three decks. The screens can be driven by an electric motor or petrol engine

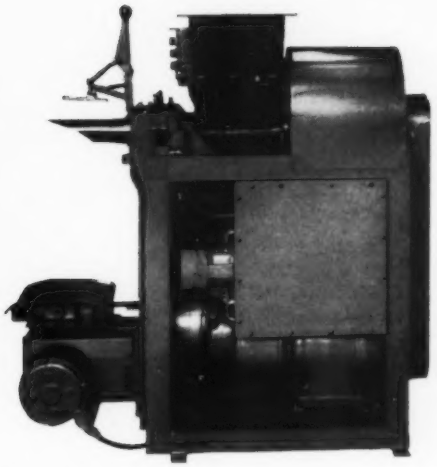
screen box. At high speeds they set up in the spring-mounted screen a motion directly contrary to their own movement. The amplitude of the action is directly proportional to the unbalanced weight of the flywheels and independent of the rotation speed. It is adjustable to varying speeds by adding or removing counter-weights bolted inside the flywheel rims. Unlike other screens, no counterbalancing is necessary to prevent transmission of vibration to the supporting structure.

Side-swaying motion is eliminated by the use of involute springs of high strength and low stiffness. It is transmitted into elliptical motion and 98 per cent isolation is achieved. Screening begins the moment the material is placed at the feed end, as opposed to a general 'binding' at this end before vibration begins to work about the centre of the screen. A forward elliptical motion at the feed end moves over-size material rapidly out of the way. In the centre the action becomes a circular movement which slows down the rate of travel and, at the delivery end, a backward elliptical motion retards the flow and allows greater time for the near-size material to find openings in the screen cloth.

Substantial stripping of the supporting structure is unnecessary when replacing screen cloths. Patented stretcher bar lifting springs automatically disengage the bar from the hooked edge of the screen cloth when exterior tension bolts are loosened, and the cloth can be withdrawn. Oil is used for lubrication, and this reduces the power necessary for operation with grease-packed units and also allows quicker starting in cold weather.

UNIVERSAL DRUM PALLET

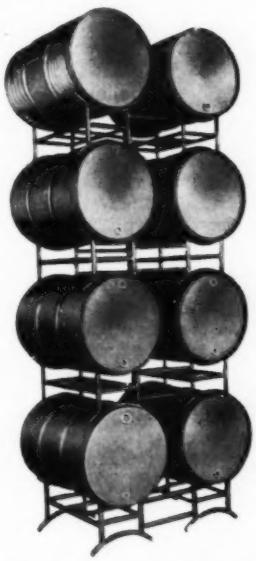
An improved version of their Stak-a-Drum pallet is announced by Powell and Co., Burry Port, Carms, South Wales. A big advantage claimed is that each drum can be lifted direct from the ground on to the pallet, using the same fork centres as



The Richardson combined weigher and valve bag-filling machine

for lifting the pallet. Moreover, fork centres are used which are suitable for most other trucking operations.

The new pallet is of simplified construction and is low in cost. It is made of tubular steel throughout and is suitable for indoor or outdoor use. It weighs less



Lightweight and simplified construction are features of the new Powell Stak-a-Drum pallet

than 40 lb, so can be carried easily by one man.

WEIGHER AND BAG-FILLING MACHINE

The Richardson Scale Co., Ltd., Albert Street, Bulwell, Nottingham, announce the production of a new combined weight and valve bag-filling machine. It is suitable for weighing difficult-to-handle powdery materials into valve sacks at the rate of 2-3/min. A bag-setting device can be incorporated so that minimum-sized sacks can be used. An agitator within the feed inlet of the machine ensures that material will not arch.

The weigher-packer has been accepted by the Board of Trade Standards Department for weights and measures acceptance, and the makers have a test unit in their works for trials with various products.

NEW FAN-COOLED MOTORS

A new range of totally enclosed fan-cooled electric motors, complying with B.S. Draft Specification A(ELE)1629, which are dimensionally inter-changeable with British Standard ventilated motors to B.S. 2960, have been introduced by Higgs Motors Ltd., Witton, Birmingham, 6. They comply with B.S. 2613 for Class E insulation, and give a similar output. They are smaller and lighter than the corresponding totally enclosed fan-cooled motor to B.S. 2083 and likewise are lower in price.

The foot-mounted range has been developed up to 7½ h.p. at 1,500 r.p.m., but at an early date it is anticipated that machines will be available up to 40 h.p. Flanged, foot and flanged or totally enclosed non-ventilated types will follow.

With the exception of the smallest frame, the stator housing is ribbed on the outside, increasing the surface area which rapidly dissipates heat. This construction also gives considerable strength to the shell design. Machines of his type are suitable for use in dirty or fluffy atmospheres. A further range of totally enclosed fan-cooled motors will shortly be available to CEMA/NEMA North American dimensions, based on the same frame sizes.

A foot-mounted example of the new Higgs totally enclosed fan-cooled electric motors

The new Joy-Sullivan Miniveyor stable-hole conveyor

STABLE HOLE CONVEYOR

The new Joy-Sullivan Miniveyor stable hole conveyor saves man power in making stable holes at the ends, and in advance, of mechanized longwall coal faces. Existing methods, often calling for hand-casting of coal, are particularly inefficient on rapidly advancing faces where delay in stable hole preparations can effect the turnround of loading machines and advance of conveyor gearheads and tailends. Other applications include its use on initial drivage of breakthroughs in bord and pillar operations and, on single-unit faces, for conveying rib-side coal adjacent to maingates where rib-side packs are required. In fact, there are many underground applications for a conveyor of this nature embodying features of portability and compactness.

It comprises a lightweight all-steel belt-carrying frame of welded construction, with electric motor and drive-pulley assembly at one end, and an adjustable return pulley, for tensioning, at the other. The entire unit can be mounted on 0·8 in castor wheels or skids, allowing movement and positioning. A 2-h.p. motorized driving-drum powers the conveyor, and is operated from a standard drill panel. Embodying its own electric motor and reduction gearing, the drum drives the belt at 175 f.p.m., conveying coal at the rate of up to 50 ton/hr. A removable hopper above the driving drum facilitates coal filling.

Although the unit employs an 18-in wide belt, carried on full-length stainless steel strips, positioned to give suitable troughing, the maximum overall width of the driving unit is only 2 ft 8½ in. This is made possible by the arrangement of motor leads, which are led to a junction box mounted on the side of the conveyor. The overall standard length of the unit is 11 ft 4 in with drum centres at 10 ft, although various lengths may be specified with drum centres ranging from 8 ft to 20 ft 4 in. The overall height is 1 ft 9¼ in, with 8-in wheels and 1 ft 3 in with skids. The 2-h.p. motor is wired for current at 125 volts, 50 or 150 cycles, and is supplied with remote starting.

Manufacturers are Joy-Sullivan, Ltd., Cappielow, Greenock, Scotland.

TRADE NOTES

Vibrating Equipment for Dutch Steelworks

The General Electric Co. Ltd., England, has received an order for eight Sherwen electromagnetic vibrating feeders for installation in the steelworks of the Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V., Ijmuiden, Holland. This brings the total value of Sherwen vibrators and feeders supplied to this company to approximately £31,000.

The accompanying illustration shows, on the right, two 48-in × 6-ft feeders already installed, each capable of handling finished sinter, 25 to 200 mm in size, at the rate of 400 tons/hr.

Freight Handling by British Railways, Western Region

British Railways Western Region are playing a big part in connection with the construction of Richard Thomas & Baldwin's new steelworks and stripmill at Llanwern (Mon.).

When the site for the proposed works was selected, the railways made immediate plans for handling rail-carried materials required for the project, especially in view of the decision to accelerate the construc-

tural work and bring the mills into production 18 months earlier than originally planned. A temporary connection for a private siding was laid on July 5th, 1959, a permanent connection being subsequently constructed by the Western Region on January 10th, 1960, to allow the contractors to proceed with the laying out of the internal lines.

Although the general construction work is proceeding, the rail siding to serve the works is not yet complete, necessitating large quantities of material being transferred from rail to road for delivery.

The railway yard at Lliswerry was chosen as most suitable for dealing with this traffic which, exceeds 2,000 tons

(*Continued on page* 509)

The illustration shows, on the right, two G.E.C. 48-in × 6-ft Sherwen electromagnetic vibrating feeders each handling finished sinter, 25 to 200 mm in size, at the rate of 400 tons/hr. The feeders form part of a large installation in the steelworks of Koninklijke Nederlandsche Hoogovens en Staalfabrieken, Ijmuiden, Holland

British Railways freight lifters working in tandem at the Lliswerry railway yard, handling concrete piles for Richard Thomas & Baldwin's new steel works at Llanwern

weekly. It consists, mainly, of 40-ft concrete piles, 60-ft steel rails and 40-ft bundles of steel reinforcing rods. To handle them, B. R. have provided heavy-duty freight-lifter fork trucks, two of which work 'in tandem'. By this method, 10-ton loads are transferred from rail to road vehicle in a matter of a few minutes and it is particularly suitable for pile traffic, two of which can be transferred in one lift.

With the progress of the work, new types of material are now being conveyed including steel sleepers, pile guides and fish-plates in containers, and with the requirements of the contractors gaining momentum, plans are being put in hand to provide additional equipment to deal with traffic as it arrives.

Mechanical Handling Engineers' Association Education Prize Scheme

In order to encourage the progress of technical education within the mechanical handling industry, the Association has decided to award in 1960, to employees principally engaged in the mechanical handling departments of its members who attain certain qualifications during the period from November 1st, 1959, to October 31st, 1960, prizes in the form of appropriate technical books or, at the discretion of the employer, in collaboration with the Education Sub-Committee of the Association, in the form of instruments and tools. No payment in cash will be made except in the case of entrance fees to professional institutions.

Whitlock Bros.

Whitlock Bros., Ltd., of Great Yeldham, Essex, have increased their share capital by the addition of 1 million (5s.) ordinary shares. The company, which is working to capacity on the manufacture of earthmoving equipment and agricultural machinery, has recently acquired adjoining land, increasing the Yeldham factory area to 30 acres. Their first building expansion programme, covering 100,000 sq. ft., is nearing completion and plans for the second phase have been submitted for planning approval.

More Nylon in Conveyor Belting

Consumption of nylon yarn for conveyor belting during 1959 was three times as great as during the previous 12 months and was still rising steadily at the end of the year. This rapid increase makes it clear that nylon is well on the way to becoming a major fibre for belting.

Solid-woven belting containing a substantial proportion of nylon is firmly established. It has been gradually improved during the past few years and now has a high reputation for toughness and durability. It is frequently used by the National Coal Board as one of the 'controls' against which new belts are tested.

Inspired by this success manufacturers have devoted great effort to the development of plied belting containing nylon. This work has been encouraged by the introduction by the National Coal Board of a 'limited approval' scheme under which quantities of about 50,000 to 100,000 ft of promising-looking belts containing man-made fibres are being bought.

The National Coal Board believes that judicious use of man-made fibres can increase the service life of conveyor belting by 50 per cent or more. Most belting manufacturers consider that nylon is the most suitable fibre for this work. The majority of the belts which had been granted limited approval by the end of last year contained nylon and substantial quantities are now in use.

In addition to these limited approval belts there are several belts containing nylon which have been given full N.C.B. approval. Manufacturers are also producing other belts containing nylon to satisfy the needs of other industries.

Big users to whom quantities are being sold include sand and gravel pits, hard stone quarries, the Central Electricity Generating Board, Stanton Iron Works and the London Brick Co. There has also been considerable overseas interest which has resulted in orders from European countries and from India, Canada, Chile, South Africa and Malaya.

A Caterpillar No. 955 Traxcavator uses a hydraulically controlled Cat ripper to break up the surface of Fencepiece Road, Hainault, Essex, prior to reconstruction. The machine, which is owned by Norman Hill plant hire, was supplied by Fred Myers, Ltd.

Further Expansion of the Chamberlain Group

The Chamberlain Group of Civil Engineering and Building Construction Companies, with headquarters at 3 Buckingham Palace Gardens, London, S.W.1, states that, as part of its policy of continual expansion, it has acquired the North country civil engineering and railway contracting firm of Grant, Lyon & Co., Ltd.

This company, with its connections with the Coal Board, the iron and steel industry and British Railways, will enable the Chamberlain Group to enter new fields of civil engineering, both in this country and abroad, and in particular, projects incorporating earth moving, railway siding installation work, pipe-laying, blast furnace lining wrecking and removal work.

The Chamberlain Group further reports that both David Grant, and Leslie Lyon, will remain as joint managing directors of the company, and the Group anticipates that the merger will introduce an increasing volume of work for the company's Scunthorpe works and its other North and West country depots.

Westalite Selenium Rectifier Manufacturing Plant for India

Despite the increasing use of silicon and germanium power rectifiers, the demand for selenium rectifiers continues to expand both in Britain and overseas. This is borne out by the fact that a complete plant for the manufacture of *Westalite* selenium rectifier elements, has been designed and manufactured in the Chippenham Works of Westinghouse Brake and Signal Co., Ltd., and shipped in one consignment to India. This quite considerable undertaking was achieved in a period of eight months.

The recipients of this *Westalite* rectifier-manufacturing plant are Hind Rectifiers Pvt., Ltd., a subsidiary company of Kaycee Industries, Ltd., of Bombay, who have been licensees in India of Westinghouse rectifiers and associated equipment since 1946 and instrumental in building up Indian rectifier markets to the very large proportions they have reached to-day. This ever-increasing demand for Westinghouse rectifiers in India has made home production desirable and to this end, Hind Rectifiers Pvt. Ltd., obtained the approval of the Ministry of Commerce and Industry —Government of India, who welcomed the project as part of India's industrial expansion programme.

With this approval behind them, Hind Rectifiers Pvt., Ltd., called on Westinghouse to design and fabricate the rectifier manufacturing processes and then acquired, in the suburbs of Bombay, a plot of land measuring some 33,000 sq. yd. on which to build the factory that will house

the plant. Personnel from the Indian company were sent to the Chippenham works of Westinghouse to gain knowledge and experience in manufacturing processes including the latest techniques applied to *Westalite* selenium rectifiers. They also personally inspected and tested all the equipment prior to packing for despatch. These engineers, who will be responsible for both the operation of the plant in India and the furthering of tuition amongst their colleagues, also hold the key to the future development of metal rectifiers and semi-conductor devices in India.

The Technical Colleges and their Government

This booklet, issued by the joint F.B.I.—Technical Colleges Committee under the auspices of the F.B.I. Education Committee, has been published by the F.B.I. It gives, from industry's viewpoint, an appraisal of the government of technical colleges in the U.K. The position is looked at in the light of industry's rapidly-growing needs for trained technical and commercial staff and the consequent necessity for increased consultation between industry, commerce and the colleges.

Section I of the booklet contains recommendations based on these considerations and on a sample survey of conditions prevailing in a number of colleges.

Other sections of the booklet deal with the finance of technical colleges in this country; the academic pattern; the structure of U.K. technical education and the historical background to it.

Bray Sales Drive in Western Germany

Bray Construction Equipment, Ltd., have entered into an arrangement with the firm of Klockner & Co., Duisburg, Germany, for the marketing of the Bray range of tractor shovels. Klockner & Co. are one of the most important firms for the supply of large construction machinery in Germany, and operate a series of sales offices in all the main towns of the West German Republic.

Bray tractor shovels exported to Germany will be fitted with the air-cooled Deutz-Dieselmotor, an engine which is incorporated in more than 90 per cent of all construction machines in Germany. The German contractor, therefore, is being offered the first British shovel to be powered by a German diesel engine.

The three models available will be the 450T with a 72-h.p. Deutz 4-cylinder air-cooled diesel engine, having a lifting capacity of 7,300 lb; the 455T powered by a 90-h.p. Deutz 6-cylinder engine, having lifting capacity of 8,000 lb; and the 460T model with a 108-h.p. Deutz 6-cylinder diesel engine. This latter model has a lifting capacity of 12,000 lb.

Top road speeds of the three models are 11 m.p.h., 26 m.p.h. and 23 m.p.h., respectively, the latter two machines having four forward and four reverse speeds. A full range of attachments will be available including hydraulic logging plant.

Bray Construction Equipment, Ltd., are members of the Sheepbridge Engineering Group.

Night Operations on Bridge

The engineering problems attached to British Railways' modernization scheme are not by any means eased by the necessity of avoiding dislocation of passenger and freight services. When the work entails rebuilding and widening a road-over-rail bridge, then the difficulties are further aggravated by the need to keep the road open—or, at least, closed for as little time as possible.

One of the answers is to do major work in the small hours of the morning and this method was adopted when the first phase of the reconstruction of the bridge carrying Hills Road, Cambridge, was carried out.

The job of positioning on the abutments 12 pre-stressed concrete beams, weighing from 24 to 13 tons and varying in length from 77 to 71 ft, and a steel-structure footbridge 96 ft long, was done by two 25-ton lorry-mounted Coles cranes of Pickfords heavy haulage service. The cranes were positioned on the abutments on either side of the bridge and, synchronized by loud hailer, lifted the beams straight from road vehicles on the bridge into position parallel with the road. The beams were brought by vehicle and bogey trailer from the manufacturer in Huntingdonshire the day before and were parked in a nearby market until they were required on the bridge.

The road over the bridge is the main route to Colchester and, despite the size of the beams and the extent of the cranes' operations, traffic was kept flowing throughout the night by closing only one lane of the bridge and having the single-lane traffic controlled at either approach by the police.

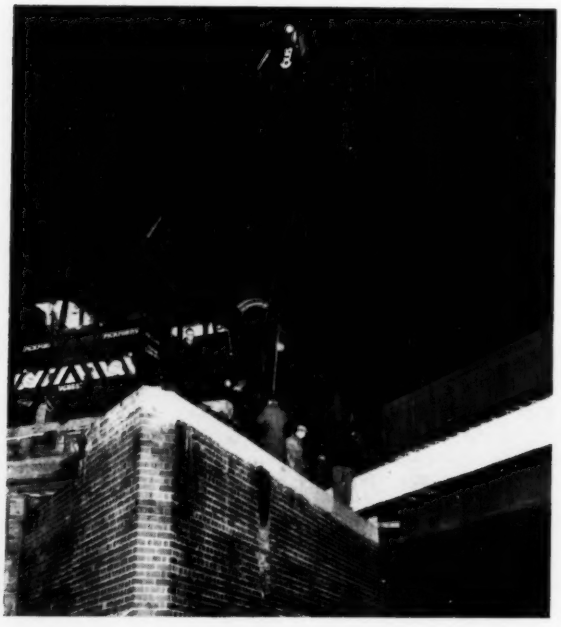
Although each lift had to be made between the passage of trains on the line below, by the following morning the operation was completed.

The work on the Hills Road bridge is a British Railways contract given to A. Monk & Co., Ltd., who sub-contracted the lifting operation to Pickfords Heavy Haulage Service.

British Ropes, Ltd., Expands Mexican Factory

Two years ago British Ropes, Ltd., established a new wire-rope factory in Mexico—Cables Mexicanos S.A. de C.V. This factory was put into operation in

(*Continued on page* 511)



Positioning pre-stressed concrete beams at Hill Road Bridge, Cambridge, part of British Railways' modernization scheme

The Bray tractor shovel with Deutz air-cooled diesel engine

record time and enabled the company to sell in the expanding Mexican market.

The success of this venture has been so marked that this company is to be expanded and a new wire mill is being built to produce the necessary wire for rope making on the spot and to meet other specialized wire requirements in Mexico. Advantage is being taken of the expansion to obtain increased participation by Mexican interests. A leading American manufacturer of wire and allied products which already has important speciality wire sales interests in Mexico has also agreed to share in this venture.

Change of Address

The Glasgow office of Turner Brothers Asbestos Co., Ltd., has been moved to 80 York Street, Glasgow, C.2. The telephone number and telex address remain unchanged and are: Central 2571, Telex 77-113.

Ransomes & Marles Bearing Co., Ltd., have moved their Leicester area office from Great Central Street to new and larger offices and stores at De Montfort House, 223 Belgrave Gate, Leicester. The telephone numbers are unchanged.

Barron & Shepherd, Ltd., materials handling engineers, have now combined their London and Dorking factories and City office and will operate from their new factory at 315 Kennington Road, S.E.11. Telephone: RELiance 6051/2/3.

Rownsons (Conveyors), Ltd.

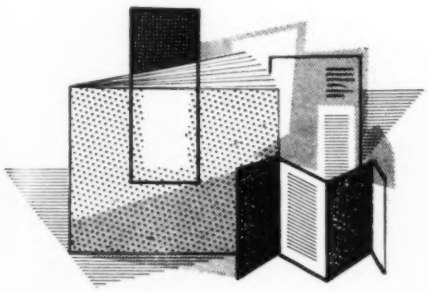
Baker Perkins announce that negotiations have now been completed for the acquisition of Rownsons (Conveyors), Ltd. The purchase price of £95,000 will be satisfied by the issue to the vendors of a sufficient number of ordinary £1 shares of Baker Perkins to yield this amount at the middle Stock Market price immediately prior to June 20th, 1960.

The directors of the company will be H. Crowther (chairman), C. N. Brown, A. G. Anderson, J. A. Marriott and H. W. Gregory.

Rownsons (Conveyors), Ltd., originated in 1909 as the engineering department of Rownson, Drew & Clydesdale, Ltd., builders' merchants, to promote the Donald patent elevated conveyor for unloading and handling bananas. Three years ago the company was formed as a wholly owned subsidiary of Rownson, Drew & Clydesdale, Ltd. It manufactures a wide range of conveying and mechanical handling equipment and has been associated to an increasing extent during recent years in the supply of this type of equipment in connection with contracts carried out by Baker Perkins, Ltd.

This latest addition to the Baker Perkins group brings its total of companies in this country, U.S.A., Canada, Germany, South America, Australia, New Zealand and South Africa to 16.

The 3,500th Euclid to be produced by the Scottish assembly line of Euclid (G.B.), Ltd., was recently delivered by Blackwood Hodge to Shellabear, Price, Ltd. The unit, a TS-24 'Twin Powered' scraper, will join the contractors' other TS-24's on the Grantham By-Pass



ABSTRACTS AND REFERENCES

Articles on mechanical handling published in all technical and industrial journals of the world are indexed and abstracted below. Whenever it is known, the published price of the journal containing the article is given.

The addresses of the publications concerned are given and applications for copies of the journals mentioned should be made direct.

SELF-DISCHARGING HOPPER

Dumping Hopper, *Engineering*, 36 Bedford Street, Strand, London, W.C.2. March 18th, 1960. P. 380. 2s.

For use with fork trucks, a self-tipping dumping hopper is described, available in four sizes of ½, 1, 1½ and 2 cu. yd. capacities. Each is designed to fit on the forks of a truck and, when raised to the required height, it is released by the driver operating a catch so that it tips forward, discharging its load. When empty, it returns to the travelling position, automatically re-engaging the catch. There are two stop dogs on the runners to prevent it tipping too far. The hoppers are of welded construction, and for special applications can be supplied in stainless steel, aluminium and metalized, galvanized or rubber-coated. Models are available with live skids, castors and metal, rubber-tyred or plastic wheels.

UNLOADING BY GRAVITY

Self-Inverting Barges, *Engineering*, 36 Bedford Street, Strand, London, W.C.1. March 25th, 1960. P. 432. 2s.

A simple method of unloading barges, which actually makes no use of mechanical equipment, is that adopted by IHC, The Hague, Holland. Said to be particularly suitable for sticky materials, this method is merely to cause a barge to turn itself through 180 deg so that the load is discharged and the bottom then becomes the

deck which in turn can be loaded and, in a similar manner, unloaded.

When the barge reaches the place of discharge, a valve below the water-line is opened to permit the flooding of a tank which causes listing to the point of vanishing stability. As soon as the load has been discharged, the tank automatically empties through the valve which is left open and is now above the waterline. The valve is then closed and the barge is ready again for re-loading.

HANDLING CASTINGS QUICKER
One-Time Handling, *Factory*, 330 West 42nd Street, New York 36, N.Y., U.S.A. March, 1960. P. 198. $1.

The handling of loose castings at Dalton Foundries Inc., Warsaw, Indiana, has, it is stated, been transformed from multi-handling to single-handling by the adoption of a new system. The key to the system is large corrugated containers stapled to expendable wooden pallets. These are loaded with the castings in work areas. They are then carried by fork lift trucks to storage areas and placed on metal racks. After an order is completed, fork trucks load the pallet-containers directly on to commercial carriers for delivery to customers. The customer simply reverses this order of handling.

FOR LIFTING AND TIPPING
Lifting Machine, *Mass Production*, 4 Ludgate Circus, London, E.C.4. March, 1960. P. 113. 2s. 6d.

Known as the Liftip, the machine described was designed to lift and tip sacks, drums, bins and other containers, and can be positioned close to the receptacle into which discharge is to be made. It has a steel frame with two lifting arms operated by independent hydraulic rams which lift and tip a hopper holding the container. Drive is by a 3-h.p. electric motor coupled direct to a hydraulic pump. The machine weighs about 5 cwt and can tip up to 6 cwt and discharge at heights from 3 ft to 8 ft. It can be supplied on wheels. Quick-release screw clamps hold drums, bins and cartons in position, and for sacks a special retractable steel claw is provided.

MAMMOTH CRANE
Record Crane for Port Weller, *Modern Power and Engineering*, 481 University Avenue, Toronto 2, Canada. February, 1960. P. 79. 50c.

Said to be the largest ever built in Canada, the crane installed in Port Weller, Ontario, to aid Great Lakes shipping is stated to be as tall as a 20-storey building and weighs 335 tons. The boom stretches 225 ft in the air and, in fact, carries aircraft warning lights. The crane moves along tracks on 16 27-in dia wheels. The operator is housed in a helicopter-type cab 70 ft above the ground. The glass enclosure is designed to give him complete visibility below as well as forward. Equipped with its own diesel-electric power plant, the crane's 140 ft boom can lift a maximum of 55 tons. An auxiliary 12 ft jib hoist attached to the main boom has a lifting capacity of 5 tons.

ASSOCIATED ILIFFE TECHNICAL BOOKS

Books Recommended by

'MECHANICAL HANDLING'

ABACS OR NOMOGRAMS

A. Giet, translated and revised by J. W. Head, M.A.(Cantab.), and H. D. Phippen, M.A.(Edin.), B.Sc. (Lond.). 35s. By post 36s.

COST ACCOUNTING AND THE ENGINEER: A text-book for Students and Apprentices

Kenneth B. Mitchell, A.C.W.A., Aff.I.W.M. 10s. 6d. By post 11s. 4d.

MATERIALS HANDLING IN WORKS STORES, SECOND EDITION: The Fork Lift Truck and Pallet System

L. J. Hoefkens. 18s. By post 19s.

PRINCIPLES OF MASS AND FLOW PRODUCTION

Frank G. Woollard, M.B.E., M.I.Mech.E., M.I.Prod.E., M.S.A.E. 25s. By post 26s. 4d.

PRODUCTION ENGINEERING: Practical Methods of Production Planning and Control

J. S. Murphy, A.I.I.A., 12s. 6d. By post 13s. 5d.

PROGRESS IN CARGO HANDLING, VOL. II

63s. By post 64s. 9d.

Obtainable from all booksellers or direct from

THE PUBLISHING DEPT.
DORSET HOUSE
STAMFORD ST., LONDON, S.E.1

HIGH-LIFT TRUCK
Lift Truck Puts Steel Way Up High, *Factory*, 330 West 42nd Street, New York 36, N.Y., U.S.A. March, 1960. P. 188. $1.

Brief reference is made to the Hi-Lifter truck made by Kwik-Mix Co., Port Washington, Wisconsin. It is a lift truck that has been lifting heavy steel material up to 35 ft for John Alibrandi Construction Co., Syracuse, N.Y. It has a lifting capacity of 6,000 lb, can travel at speeds up to 18 m.p.h. and can climb a 70-deg incline when fully loaded. To provide greater versatility a pallet fork, combination lift arm and hook and vertical clamp arms can be used with the vehicle.

INCLINED CONVEYANCE
Conveyor Belt Carries Objects up Inclines, *Power Engineering*, 308 E. James Street, Barrington, Illinois, U.S.A. March, 1960. P. 96. $1.

The Dura-A-Lift belt described is designed for carrying objects up an incline as steep as 45 deg, and some objects up a 50 deg incline. It is claimed that it will convey smooth, rough or slippery objects without sliding. The top cover consists of parallel, transverse inverted V-ridges of wear-resistant Dulon, making it more resistant to abrasion, gouging, tearing and oxidation. The deep V-ridges are said to be self-cleaning and assure maximum grip action. Balanced belt construction equalises ply stress so that each ply pulls its full share of the load. The belt is available in 3- or 4-ply 28 oz duck and can be obtained with moulded edges, bottom cover and other fabrics up to 48 in wide.

GIANT PRIME MOVER
Prime Mover Reported Ready for Test, *Product Engineering*, 330 West 42nd Street, New York 36, U.S.A. March 21st, 1960. 50c.

A 70-ton 750 b.h.p. prime mover built by the International Harvester Co. is said to have reached the testing stage and to be larger than any other machine of this type, indicating an expanding trend toward huge construction equipment. It consists of two prime movers hitched back-to-back by means of a central pivot, allowing a short turning radius and excellent manœvrability. Components from standard International Harvester Series 95 two-wheel units are used, tied together by a common control system. Each sub-unit is powered by a 375 b.h.p. turbo-charged diesel engine, and two transmission systems drive the dour 8 ft dia pneumatic-tyred wheels. The driver sits above the central pivot and his seat will turn in either direction since the machine can travel forward and backward with equal ease. Top cross-country speed is given as 30 m.p.h.

HANDLING BY GRAVITY
Self-Inverting Barges, *Engineering*, 36 Bedford Street, Strand, London, W.C.2. March 25th, 1960. P. 432. 2s.

A simple method of unloading barges, which actually makes no use of mechanical equipment, is that adopted by IHC, The Hague, Holland. Said to be particularly suitable for stick materials, this method is merely to cause a barge to turn itself over through 180 deg so that its load is discharged and the bottom then becomes the deck which can in turn be loaded and in a similar manner be unloaded. When the barge reaches the place of discharge, a valve below the waterline is opened to permit the flooding of a tank which causes listing to the point of vanishing stability. When the load has been discharged, the tank automatically empties through the valve, which is now above the waterline and is left open. The valve is then closed and the barge is ready again for re-loading and inverting.

ROAD OR RAIL CRANE
Three Machines in One, *Railway Track and Structures*, 30 Church Street, New York 7, N.Y., U.S.A. March, 1960. P. 6. 75c.

Known as the Truco turret derrick, the machine described is equipped for operation as an aerial boom, universal derrick or earth digger and can be fitted with flanged wheels for operation on either road or rail. Available in five models, it has a three-stage telescoping boom which will lift 500 lb to working heights of from 30 ft to 100 ft, a 15,000-lb winch line for use with the boom as a derrick or in any normal winch operation, and a 20 in or 30 in dia earth

augur. An insulated two-man fibre glass basket is located at the end of the telescopic boom. A 4×6 ft aluminium platform is also available. The capacity is said to be 2,000 lb when the boom is horizontal and fully extended. Stability is provided by outriggers and jacklegs, the latter at the four corners of the chassis. All operations of the machine are hydraulic.

TELESCOPIC STACKER
Drum Stacker, *Industrial Equipment News*, 33 Tothill Street, London, S.W.1. Mid-March, 1960. P. 15.

As it is only 28 in wide, the Lodematic hydraulic drum stacker described can negotiate narrow gangways, and it also telescopes to give low minimum overall height so that it can go through low doorways. The hydraulic equipment is foot-operated, and drums up to 500 lb in weight can be raised to a maximum height of 14 ft. It has two lifting speeds, and a knurled knob at hand level controls the lowering speed. Drums can be halted at any point for discharge into process plant or for off-loading on to racks or vehicles. Wheels running on needle roller bearings are fitted, and a parking brake is an optional extra. Electric mains- and battery-powered versions are also available.

REMOVING SCRAP
Scrap-Handling Programs, *Australian Machinery and Production*, 243 Elizabeth Street, Sydney, Australia. January, 1960. Pp. 17-20.

The author of an illustrated article dealing with the most profitable methods of handling scrap first points out that it can be done by 20 men with baskets or by one man with a push-button. There are, it is stated, four basic objectives to be achieved i.e., reduction of down-time, reduction in man-hours, fast removal from production areas and better utilization of plant space. The exact type of system to be used to accomplish these objectives depends upon scrap volume, machine tool arrangement, special processing requirements and method of disposal. These factors are considered in detail, and reference is made to the various types of handling equipment available as well as actual installations where their time- and labour-saving value has been demonstrated.

AUTOMATIC PARTS HANDLING
Lamb Storage-Feeder Unit, *Machinery*, 93 Worth Street, New York 13, N.Y., U.S.A. March, 1960. P. 206. $1.

With a capacity for handling up to 12,000 parts, the storage-feeder unit described has recently been introduced by Jas. Lamb Co., Detroit, Michigan, and has been designed to bank as well as feed parts in automatic parts handling installations. Standard units, floor or suspended models, are comprised of from one to six storage decks which can handle one or several different parts simultaneously. Each deck is a spiral track that can be wound into single or multiple-part lanes. Parts enter at the outer diameter of the deck, then travel through the spiral course to the centre where they are discharged to the next lower deck or to processing.

The spiral track is made of hardened and polished spring steel side and ride rails which minimize friction and part-nicking. Movement of the parts is by means of double-row nylon brushes attached to wiper arms, usually six per deck, mounted on a centre shaft driven by a fractional horsepower motor and speed reducer. Input storage and output feed rate are adjustable up to 6,000 parts per hour by pulley changes.

RECENT PATENTS

The following are brief extracts of recent United Kingdom patents which we believe will interest our readers. For full details the original patent specifications should be consulted at, or bought (3s. 6d. each) from, The Patents Office, Southampton Buildings, Chancery Lane, London, W.C.2.

CRANE TRUCKS
Buckley Myers & Taylor, Ltd., of Lancashire—U.K. 821338.

A dock or factory mobile crane, powered and with extensible post, operated by double-acting plunger and having cable haulage.

BISCUIT HANDLING
Forgrove Machinery Co., Ltd., of Leeds—U.K. 821348.

Consider coating and wrapping of biscuits after baking and cooling on conveyors. The main aim is a form of band width narrowing, for ease of cornering, using feed down an incline from the first conveyor to hoppers, then drop down on to the narrow conveyors, using a short stretch of accelerator conveyor to space out the objects.

PARTICLE CONVEYOR
F. Fahrni, of Zurich—U.K. 821354.

A constant layer thickness of wood chips on conveyors is arranged by a dam and two sensors across the width to actuate a distributor, for feeding hot pressed board making machine.

OVERHEAD SHOVEL
Aktiebolaget Nordpatent - Stockholm—U.K. 821359.

Form of hoist for tractor usage to drive an overhead throwing dredge bucket, with the shovel boom mounted on the cabin roof and having an adjustable length.

EARTH WORKER TEETH
H & L Tooth Co., of California—U.K. 821420.

Scarifier, power shovel and ditcher teeth are set in deformable housings, with the tool as a lever with projecting tip.

BELT ALIGNMENT
Stephens Adamson Manufacturing Co., of Illinois—U.K. 821433.

Form of belt aligning pulley with drift eliminator using a bend pulley with self aligning bearings on levers under conveyor.

TIPPER
M. Dostal, of Czechoslovakia—U.K. 821534.

A vehicle load tipper with automatic tipper device to overcome troubles due to wear and any slight twisting of the truck body, using a fluid pressure operated catch system.

BAKERY CONVEYOR
T. & T. Vicars, Ltd., of Newton-le-Willows—U.K. 821545.

Complete mechanical handling system from oven to truck loading, with a cooler section in the track and a system of switching to stand-by slicer wrappers if needed. The equipment can work with two streams and feed two or three removal conveyors, using a pivoted switch conveyor feed. Patent 819285 is discussed.

HYDRAULIC LOADER
F. Weatherill, of Welwyn—U.K. 821554.

A motorized shovel, trencher or crane system for light excavation work, etc., using a hydraulic ram for controlling the roll back action directly or through a linkage. Shocks are dissipated over a wide area, has an increased angle of stroke and uses head stabilisation.

TRANSPORTER RAILS
C. J. Allen, of New Zealand—U.K. 821581.

Grading and sorting layout for carcasses etc., somewhat as per patent 817733 in its form of sorting switch. The aim is to avoid bunching and damage with, also, an arrangement to hold part of the load stationary for a while whilst not affecting the drive-normal spacing being say 18 in and close stacking being 6 in separation.

CARGO UNLOADER
W. G. Bartenfeld, of Ohio—U.K. 821591.

An improvement on patents 813037/8 for ship unloading using a pivoted boom of reduced overall height, with the crane carrying bucket trolleys, with a conveyor fed from hoppers running along the centre of the frame.

CONVEYORIZED COOLER
F. L. Smith & Co. A/S. of Copenhagen—U.K. 821687.

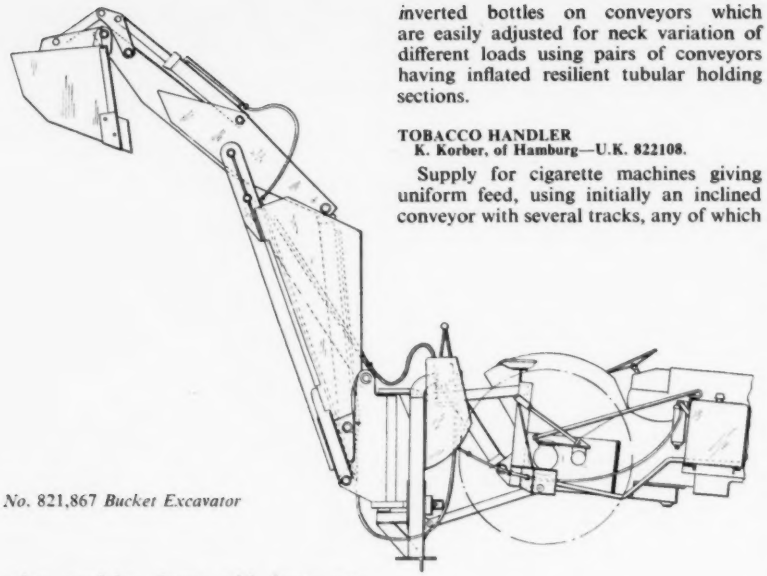
Bulk conveyor with heat exchange for cooling, e.g. of clinker, burnt lime etc., so arranged that the material depth is varied along the section, i.e. deeper as the temperature drops, so the pressure drop in the coolant air is nearly constant along the length-achieved by means of varied speed of different sections.

LIFT TRUCK
Yale & Towne Manufacturing Co., of New York—U.K. 821724.

A type of masted lifter using chains on the carriage, aiming to avoid undue shock wear, by use of a form of lever pivot spring bearing acting against the load member.

FIBRE HANDLING
C. V. Smith, of Quebec—U.K. 821727.

Mine handling conveyors for asbestos rock fibre, which avoids under battering of quickly released long fibres, by operating in a series of steps with fibre removal at each stage. Rocks are impacted at high speed against disintegrators for a short while, then the products classified by gravity and rock remaining further treated



No. 821,867 *Bucket Excavator*

using revolving drums with inner projecting ribs.

BOOM LOADER
Clark Equipment Co., of Michigan—U.K. 821746.

Pivoted type of boom tractor for handling loads which avoids accidental dumping, using hydraulic control which can be an automatic system of presetting the load angle.

TANKERS
Chr. Olsson I. Falkenburg A.G., of Sweden—U.K. 821781.

Design of tail rankers of generally cylindrical shape partitioned with flexible diaphragms, especially for use with liquids.

FLUIDIZED COAL RAISING
T. Nagami, of Tokyo—U.K. 821795.

A liquid pipe system for transporting coal from underground mines, with added injection of compressed air as an aid to lifting, using a pneumatic accumulator system, and given form of coal input from hoppers.

MAGNETIC ROLLERS
H. Spodi, of Westphalia—U.K. 821866.

Permanent magnet roller conveyors with opposite polarity next to each other, to increase the pressure when handling magnetic materials.

BUCKET EXCAVATOR
C. J. Bamford, of Uttoxeter—U.K. 821867.

Mounting behind tractor with boom on pivoted slewing frame, arranged so no ballast weight needed on tractor, or very little. A beam post rests on the ground during operation.

CONVEYOR TENSIONING
Stahlwerke Bruninghaus G.m.b.H., of Westphalia—U.K. 821970.

Improvement on patent 792329 using a motor-operated hydraulic thrust device for power tensioning of cable or chains used to drive conveyors.

CONTAINER CLEANER
Pneumatic Scale Corporation, of Massachussetts—U.K. 821885.

Handling at high speed with minimum damage using air jet cleaning or drying of inverted bottles on conveyors which are easily adjusted for neck variation of different loads using pairs of conveyors having inflated resilient tubular holding sections.

TOBACCO HANDLER
K. Korber, of Hamburg—U.K. 822108.

Supply for cigarette machines giving uniform feed, using initially an inclined conveyor with several tracks, any of which can be stopped, and rake wheels to control tobacco depth, followed by vibrator feed into pneumatic pipes which finally lead to the maker device.

SPEED CONTROL
Geo. J. Meyer Manufacturing Co., of Wisconsin—U.K. 822113.

Improved bottle handling system somewhat as per patent 749235 using chain driven conveyors and upright bottles, several labellers being fed from one stream. Run speed is varied according to label rate, which labellers are working and whether bottles are accumulating.

SHIPS CRANES
Friede & Goldman Inc., of New Orleans—U.K. 822135.

Lay-out for cargo ship with strong hull and multiple hatches, having derrick bridge or pier cranes or mast boom and winch systems in groups to unload quickly, using hinged between decks, and perhaps additional bulkheads and inner hulls to add strength. Loading time can be reduced 40 per cent, reaching 800 ton/hr and mixed cargoes being acceptable.

REVOLVING CRANES
Maschinenfabrik Augsburg, of Nurnberg—U.K. 822187.

Motor driven road and site crane which can be hand-mechanically steered, or power operated, with a given form of lock on steering to give drive to one coupling or the other.

EARTH MOVER
Warner & Swasey Co., of Cleveland—U.K.822256.

Design with telescopic boom having suitable trencher or grader tool, which is tilted by movement of a simple outer projecting part of the boom, so that main part does not have to rotate.

FISH HANDLING
R. G. T. Baader, of Lubeck—U.K. 822263/4/5.

Fish dressing equipment for detailing and heading fish using a pair of rotating knives and conveyorized systems at a high rate, using a given form of holder catching fish by their tail end, moving on and dropping to the next conveyor by gravity. At some stages the fish drop belly down and are held by side grippers and centred as they move along.

COLLAPSIBLE CONTAINER
Union Carbide Corporation, of New York—U.K. 822289.

For use with powders, especially plastics-p.v.c. polythene etc., to avoid contamination and fire hazards and with slight gas pressure inside. Neoprene coated laminated fabric with flexible mouth and plastic pouter, closed by draw-string easily handled by crane or lift truck.

SCAFFOLDING TOWER
J. Lockner & G. Long, of Graz—U.K. 822299.

For use with builders hoists up the middle or to one side. Light and quickly erected with variable access openings where desired, made from braced lattice sections, having ladder-like struts at one side.

FLOUR DISCHARGE
Conveyors (Ready Built), Ltd., of Stroud—U.K. 822337.

Steady controlled delivery flour to processing conveyor, e.g. for packaging. Hoppers feed a platform-segmented conveyor of variable speed, via a pivoted tension member using a ratchet and pawl.

HYDRAULIC SHOVEL
F. Weatherill, of Potters Bar—U.K. 822362.

Loader or digger useful at chalk quarries etc., with flexible control for scoops with roll back on the rear pivot without raising lift arms, and reducing the ram stress, by use of locked oil circuits when digging.

GARAGES
M.A.N., of Nurnburg—U.K. 822401/2.

Multi-storey garage with trolley using thrust members near the front wheels of the car which are displaceable by opposed positive drive under fluid control, and acting on the inside of the wheels in one design.

TOBACCO HANDLING
J. M. de Kock, of Southern Rhodesia—U.K. 822438.

Simple device for handling tobacco leaf in the field, using a bar for holding the leaves on a frame for running between rows of plants.

HAND TRUCKS
Salisbury Precision Engineering, Ltd., of Wiltshire—U.K. 822481.

Device for easy tilting of truck to clear ground, movably connected to the frame and having rollers bearing on the ground.

CONVEYOR MARKING
J. O'Keefe, in U.K. 822501

Marker arrangement actuated by detector on conveyor, e.g. by means of interrupted beam, to work an ink roller via an electro-magnet so printing on top of packets, etc.

HAND TRUCK
Pelding Industries, Ltd., of Bristol—U.K. 822505.

Easier to handle when loaded by means of auxiliary wheels, under the main frame, with an abutment to limit rearward movement.

catching
on and
gravity.
ly down
centred

ork—U.K.

specially
avoid
nd with
e coated
uth and
ng easily

822298.
up the
quickly
penings
d lattice
s at one

oud—U.K.

lour to
ckaging.
ed con-
pivoted
nd pawl.

2362.
quarries
ops with
without
the ram
ts when

y using
heels of
opposed
rol, and
s in one

sia—U.K.

tobacco
holding
between

Wiltshire

to clear
e frame
ground.

y detec-
f inter-
r via an
top of

821505.
ed by
he main
it rear-

y 1960